N00164.AR.001190
NSA CRANE
5090.3a

LETTER AND ATTACHED CERTIFICATION STATEMENT AND FINAL RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION (RFI) FOR UNEXPLODED ORDNANCE 7 (UXO 7) RANGES NSA CRANE IN
07/01/2009
NSA CRANE

N00164.AR.001190
NSWC CRANE
5090.3a

DEPARTMENT OF THE NAVY
CRANE DIVISION
NAVAL SURFACE WARFARE CENTER
300 HIGHWAY 361
CRANE INDIANA 47522-5001

IN REPLY REFER TO:
5090/S4.7.1
Ser 0592/9159
23 JUL 2009
7-1-2009 (put in) KS

U.S. Environmental Protection Agency, Region V
Waste, Pesticides, & Toxics Division
Waste Management Branch
Corrective Action Section LU-9J
77 West Jackson Blvd.
Chicago, IL 60604

Dear Mr. Ramanauskas:

Crane Division, Naval Surface Warfare Center submits the Draft RCRA Facility Investigation Report (RFI) for the UXO 7 Ranges. One copy of the report is provided for your review and comment as enclosure 1. The permit required Certification Statement is provided as enclosure 2.

If you require any further information, my point of contact is Mr. Thomas J. Brent, PRCR43, at 812-854-6160, email thomas.brent@navy.mil.

Sincerely,

J. M. Hunsicker
J. M. HUNSICKER
Environmental Protection Mgr
By direction of the Commander

Enclosures: 1. Draft RFI Report for the UXO 7 Ranges
2. Certification Statement

Copy to:
ADMINISTRATIVE RECORD
NAVFAC MW (Howard Hickey) (w/o encl)
IDEM (Doug Griffin)
TTNUS (Rick Barringer) (w/o encl)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

James H. Hansick
SIGNATURE

Environmental Protection Mgr
TITLE

07/21/09
DATE

Enclosure (2)

Comprehensive **L**ong-term **E**nvironmental **A**ction **N**avy

CONTRACT NUMBER N62467-04-D-0055

Rev. 0
07/09

FINAL
Resource Conservation and Recovery Act
Facility Investigation
for
UXO 7 Ranges

Naval Surface Warfare Center
Crane Division
Crane, Indiana

Contract Task Order F272

July 2009

NAVFAC
Naval Facilities Engineering Command
Midwest
201 Decatur Avenue
Building 1A, Code EV
Great Lakes, Illinois 60088

TETRA TECH NUS, Inc.

FINAL
RESOURCE CONSERVATION AND RECOVERY ACT
FACILITY INSPECTION
FOR
UXO 7 - RANGES

NAVAL SURFACE WARFARE CENTER
CRANE DIVISION
CRANE, INDIANA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command
Midwest
201 Decatur Avenue
Building 1A, Code EV
Great Lakes, Illinois 60088

Submitted by:
Tetra Tech NUS, Inc.
234 Mall Boulevard, Suite 260
King of Prussia, Pennsylvania 19406

CONTRACT NUMBER N62467-04-D-0055
CONTRACT TASK ORDER F272

JULY 2009

PREPARED UNDER THE SUPERVISION OF:

Richard Barringer

RICK BARRINGER
PROJECT MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

APPROVED FOR SUBMITTAL BY:

John Trepanowski

JOHN J. TREPANOWSKI, P.E.
PROGRAM MANAGER
TETRA TECH NUS, INC.
KING OF PRUSSIA, PENNSYLVANIA

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

APPENDICES

TABLES

NAME

FIGURES

NAME

ACRONYMS

%R	Percent recovery
ADAF	Age-dependent adjustment factor
ALM	Adult lead model
ATSDR	Agency for Toxic Substances and Disease Registry
BAF	Bioaccumulation factor
BERA	Baseline Ecological Risk Assessment
bgs	Below ground surface
Bu	Burnside Loam
CA EPA	California Environmental Protection Agency
CDI	Chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
cm	Centimeter squared
CMS	Corrective Measures Study
COC	Chemical of concern
COPC	Chemical of potential concern
cPAH	Carcinogenic polynuclear aromatic hydrocarbons
CSF	Cancer slope factor
CSM	Conceptual site model
CTE	Central tendency exposure
CTO	Contract Task Order
DAF	Dilution attenuation factor
DoD	Department of Defense
DQI	Data quality indicator
DR	Demolition Range
DI	Deionized
EC	Environment Canada
EC_{10}	Effects concentration 10 percent
EC_{20}	Effects concentration 20 percent
EC_{25}	Effects concentration 25 percent
EcoSSL	Ecological Soil Screening Level
EEQ	Ecological Effects Quotient
EMR	Environmental Monitroing Reports

EPC	Exposure point concentration
ERA	Ecological Risk Assessment
ESL	Ecological screening level
EU	Exposure unit
FOL	Field Operations Leader
GPS	Global Positioning System
HASP	Health and Safety Plan
Hd	Haymond silt loam
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	Hazard index
HMW	High molecular weight
HQ	Hazard Quotient
IA	Installation Assessment
IAS	Initial Assessment study
IDEM	Indiana Department of Environmental Management
IEUBK	Integrated Exposure Uptake Biokinetic
ILCR	Incremental Lifetime Cancer Risk
IDNR	Indiana Department of Natural Resources
IRIS	Integrated Risk Information System
IUPPS	Indiana Underground Plant Protection Service
K_d	Distribuiton coefficient
K_{oc}	Organic carbon partition coefficient
K_{ow}	Octanol/water partition coefficient
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
LOAEL	Lowest observable adverse effect level
LOEC	Lowest observed effects concentration
m^3	meter cubed
MATC	Maximum Acceptable Toxicant Concentration
MC	Munitions constituent
MCS	Media Cleanup Standard
MDL	Method detection limit
mg/kg	Milligram per kilogram
MEC	Munitions and explosives of concern
MI	Mobility Index

MMRP	Military Munitions Response Program
MRL	Minimal Risk Level
MS	Matrix spike
MSD	Matrix spike duplicate
NAVFAC	Naval Facilities Engineering Command
NCEA	National Center for Environmental Assessment
NECC	Nutrient and energy cycling check
NEESA	Naval Energy and Environment Support Activity
NOAEL	No-observable-adverse-effects-level
NOEC	No observed effects concentration
NPL	National Priorities List
NSWC	Naval Surface Warfare Center
OB	Open burning
OPPTS	Office of Prevention, Pesticides, and Toxic Substances
ORNL	Oak Ridge National Laboratory
ORR	Old Rifle Range
OSWER	Office of Solid Waste and Emergency Response
PAH	Polynuclear aromatic hydrocarbon
PPE	Personal protective equipment
PPRTV	Provisional Peer Reviewed Toxicity Value
PRG	Preliminary remediation goals
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
%R	Percent recovery
RAGS	Risk Assessment Guidance for Superfund
RBC	Risk-based concentration
RCRA	Resource Conservation and Recovery Act
RfD	Reference dose
RFI	RCRA Facility Investigation
RISC	Risk Integrated System of Closure
RL	Reporting limit
RME	Reasonable maximum exposure
RPD	Relative percent difference
SERA	Screening-Level Ecological Risk Assessment
SOP	Standard Operating Procedure

SQG	Soil Quality Guideline
SSL	Soil Screening Level
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TEC	Threshold effects concentration
TtNUS	Tetra Tech NUS, Inc.
TOM	Task Order Manager
TRV	Toxicity reference value
TRW	Technical Review Workgroup
TV	Threshold value
UCL	Upper confidence limit
U.S. EPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UXO	Unexploded Ordnance
µg/dL	Microgram per deciliter
µg/kg	Microgram per kilogram
VIM	Voluntary Interim Measures
VOC	Volatile organic compound
XRF	X-Ray Fluorescence

EXECUTIVE SUMMARY

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) presents the results of the surface soil investigation conducted at UXO 7 located at the Naval Surface Warfare Center (NSWC), Crane, Indiana. Tetra Tech NUS, Inc. (TtNUS) prepared this report for the United States Navy, Naval Facilities Engineering Command (NAVFAC) Midwest under Contract Task Order (CTO) 0034 of the Comprehensive long-Term Environmental Action Navy (CLEAN) IV Contract Number N62467-04-D-0055. The purpose for this investigation was to determine whether munitions constituents (MC) (primarily metals) and polynuclear aromatic hydrocarbons (PAHs) from clay targets were present at concentrations greater than screening levels, the nature and extent of any contamination, and whether significant risk was present.

PURPOSE OF REPORT

The report summarizes RFI field activities conducted in 2007, describes the nature and extent of contamination, and presents human health and ecological risk assessments. All RFI fieldwork and the development of the baseline human health and screening-level ecological risk evaluations were conducted in accordance with the United States Environmental Protection Agency (U.S. EPA)-approved Quality Assurance Project Plan (QAPP) Addendum No. 2 for UXO 5 and UXO 7 (TtNUS, 2007).

SITE DESCRIPTION

UXO 7 is located within Solid Waste Management Unit (SWMU) 7, which is centrally located within NSWC Crane. Several investigations have previously been conducted at SWMU 7 under the Navy Environmental Restoration Program, and during those investigations, three new ranges were identified, the former West Trap Range, former East Trap Range, and former South Pistol Range. Because lead was not previously investigated at SWMU 7, the Old Rifle Range (ORR), along with its Main Target Area and associated shooting lanes, was also incorporated into this field investigation. None of the ranges identified are currently in use at UXO 7 and are closed. The investigation of these ranges was conducted under the Military Munitions Response Program (MMRP).

FIELD AND ANALYTICAL PROGRAM

Metals, primarily lead from bullets and shot, and PAHs from clay targets at the skeet and trap ranges, were the primary constituents of concern for the analytical program for surface soil.

A total of 189 soil sample locations were identified among the main areas of concern and subsequently sampled at depths to 2 feet below ground surface (bgs). The soil from each sample location was homogenized, and a representative portion was selected for analysis. Each sample collected was initially analyzed in the field for lead by X-Ray Fluorescence (XRF) equipment in accordance with Standard Operating Procedure (SOP) CTO034-07. Select representative samples were then sent to a fixed-base laboratory for Target Analyte List (TAL) metals analysis. Based on the composition of clay pigeons used at the East and West Trap Ranges, some samples collected within those two areas were also analyzed for PAHs.

A few sample locations located at the 400-yard firing berm (X7SB045, X7SB046) and an area located between the 400- and 500-yard firing berms (X7SB055) had initial average field XRF readings greater than the 400 milligrams per kilogram (mg/kg) screening level. Additional samples were then collected in these areas to delineate any lead contamination.

To define risk at UXO 7, the human health and ecological risk assessments divided UXO 7 into three distinct zones for evaluation: (1) Northern Zone (500- and 400-yard firing positions and dirt mound); (2) Central Zone (300-, 200-, and 100-yard firing positions and former East and West Trap Ranges); and (3) Southern Zone (main targets and barricade, hillside impact area, and former South Pistol Range).

HUMAN HEALTH RISK ASSESSMENT

The human receptors evaluated for UXO 7 were the construction worker, maintenance worker, occupational worker, adolescent trespasser, child and adult recreational user, and future adult and child residents. Surface soil was the human health exposure pathway evaluated for UXO 7.

No significant potential human health risks are expected for exposures to surface soil under current land use at UXO 7. Under future land use, non-carcinogenic and/or carcinogenic risks exceeded U.S. EPA risk benchmarks for future construction workers and hypothetical future residents. The risk to construction workers was due to exposure to manganese via inhalation of dust and particulates. As discussed in the human health risk assessment (HHRA), the concentrations of manganese were found to be at background levels at NSWC Crane and therefore the associated risks are not considered to be related to past site activities. The risks for future residents were due to direct exposure to carcinogenic PAHs in surface soil under the unlikely assumption that UXO 7 was to be developed for residential use in the future. The risk is associated with PAH exceedances in samples X7SS1210002 and X7SS1230002. Removal of surface soil within the area of these two sample locations would achieve acceptable chemical concentrations for hypothetical future residents (adult/child).

ECOLOGICAL RISK ASSESMENTS

A screening-level ecological risk assessment (SERA) was conducted at UXO 7. The ecological receptors evaluated in the screening assessment include those directly exposed to chemicals in surface soil (i.e., plants, soil invertebrates, herbivorous birds and mammals, soil invertebrate-eating birds and mammals, and reptiles).

Chemicals retained as COPCs were further evaluated as part of the Step 3a refinement process. The COPCs initially selected then underwent further evaluation as part of the Step 3a evaluation process. Lead was the only contaminant retained as a COPC because the NOAEL EEQ for the woodcock, based on less conservative food-chain models, was much greater than 1.0 in the sample locations near the 400-yard firing berm at the ORR in the Northern Zone.

CONCLUSIONS

Table ES-1 contains a summary of receptor-specific human health risks and hazards and ecological risks and identifies critical pathways and chemicals of concern for UXO 7, and where necessary, presents recommendations for further actions.

Upon evaluation of the data obtained during this investigation, the consideration of site operational history, the data generated during past investigations, and the development of baseline HHRA and SERA for UXO 7, the following conclusions were reached:

- The soil data collected during the RFI were adequate to support the development of baseline human health and screening-level ecological risk assessments for UXO 7.

- Lead and PAHs, the primary constituents of concern at UXO 7, were detected at concentrations greater than screening levels in surface soil.

- UXO 7 incremental cumulative cancer risks for all human receptor pathways were estimated to be within, or less than, the EPA risk range of $1x10^{-6}$ to $1x10^{-4}$; therefore, the Navy believes the risk is acceptable.

- Risks to terrestrial plants and invertebrates from organic and inorganic chemicals in surface soil at UXO 7 were estimated to be low to negligible.

- Risk to mammals and birds from lead in surface soil were determined to be unacceptable in the Northern Zone. However, for the receptors at risk from copper and lead within the Northern Zone, removal of all samples with lead concentrations greater than 400 mg/kg (X7SS0390002, X7SS0460002, X7SS0550002, and X7SS1740002) would achieve acceptable chemical concentrations for ecological protection.

TABLE ES-1

SUMMARY OF RECEPTOR-SPECIFIC HUMAN HEALTH RISKS AND HAZARDS, ECOLOGICAL RISKS, AND RECOMMENDATIONS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Receptor Population	Environmental Medium	Overall Carcinogenic Risk (Human)	Overall Hazard Index (Human)	Overall Risk (Ecological)	Critical Pathways and Chemicals of Concern	Recommendations
Construction Workers (future land use)	Surface Soil	3.0E-07 1.0E-06 1.0E-06	0.006 0.5 5.0	NA	- Soil dermal contact (surface) - Soil ingestion (surface) - Inhalation of air/dust/emissions (surface) (manganese)	NFA
Maintenance Workers (current and future land use)	Surface Soil	3.0E-07 1.0E-06	0.0007 0.03	NA	- Soil dermal contact (surface) - Soil ingestion (surface)	NFA
Occupational Workers (current and future land use)	Surface Soil	8.0E-06 1.0E-05	0.007 0.3	NA	- Soil dermal contact (surface) - Soil ingestion (surface)	NFA
Adolescent Trespassers (6 to 17 years) (current and future land use)	Surface Soil	2.0E-06 2.0E-06	0.04 0.006	NA	- Soil dermal contact (surface) - Soil ingestion (surface)	NFA
Small Child (0 to 6 years) Recreational User (future land use)	Surface Soil	9.0E-06 1.0E-05	0.007 0.3	NA	- Soil dermal contact (surface) - Soil ingestion (surface)	NFA
Adult Recreational User (future land use)	Surface Soil	3.0E-06 2.0E-06	0.001 0.03	NA	- Soil dermal contact (surface) - Soil ingestion (surface)	NFA
On-base Residents (Children) (future land use)	Surface Soil	5.0E-05 2.0E-04	0.04 3.0	NA	- Soil dermal contact (surface) - Soil ingestion (surface) (carcinogenic PAHs)	Proceed to CMS
On-base Residents (Adult) (future land use)	Surface Soil	1.0E-05 3.0E-05	0.006 0.4	NA	- Soil dermal contact (surface) - Soil ingestion (surface) (carcinogenic PAHs)	Proceed to CMS
Terrestrial Plants and Invertebrates	Surface Soil	NA	NA	Acceptable	NA	NFA
Mammals and Birds	Surface Soil	NA	NA	Unacceptable	Lead	Proceed to CMS

NA = Not applicable.
NFA = No further action.
PAHs = Polynulcear aromatic hydrocarbons.
CMS = Corrective Measures Study.

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) was performed for the United States Navy, Naval Facilities Engineering Command (NAVFAC) Midwest by Tetra Tech NUS, Inc. (TtNUS) under Contract Task Order (CTO) 0034 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) IV Contract Number N62467-04-D-0055. Unexploded Ordnance (UXO) 7 is a closed military range. Investigations of closed military ranges are conducted under the Navy Military Munitions Response Program (MMRP). The Department of Defense (DoD) has specified that MMRP investigations be conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Naval Surface Warfare Center (NSWC) Crane is not listed on the CERCLA National Priorities List (NPL); therefore, the investigation of UXO 7 at NSWC Crane was conducted under the RCRA Corrective Action Program.

1.2 FACILITY DESCRIPTION

NSWC Crane is located in the southern portion of Indiana, approximately 75 miles southwest of Indianapolis and 71 miles northwest of Louisville, Kentucky, immediately east of Crane Village and Burns City (Figure 1-1). NSWC Crane encompasses 62,463 acres (approximately 98 square miles), most of which are located in the northern portion of Martin County. Smaller portions of NSWC Crane are located in Greene, Daviess, and Lawrence Counties. NSWC Crane is located in a rural, sparsely populated area. Most of NSWC Crane is forested, and the surrounding area is wooded or farmed land.

NSWC Crane provides material, technical, and logistical support to the Navy for equipment, shipboard weapons systems, and nonexpendable ordnance items. In addition, NSWC Crane supports the Crane Army Ammunition Activity with production, renovation, storage, shipment, demilitarization, and disposal of conventional ammunition.

1.3 SITE DESCRIPTION

UXO 7, including the former West Trap Range, former East Trap Range, former South Pistol Range, and former Old Rifle Range (ORR), is located within Solid Waste Management Unit (SWMU) 7, which encompasses approximately 20 acres at NSWC Crane. UXO 7 is located immediately west of NSWC Crane Highway 8 in the flat-lying floodplain of Turkey Creek (Figure 1-2). The site consists of a flat grass-covered area bisected from north to south by an unnamed but maintained gravel road. This road provides access to various groundwater monitoring wells located within SWMU 7 and to an active powder burning area that is a RCRA-permitted open burning (OB) facility. The four closed ranges (West Trap Range, East Trap Range, South Pistol Range, and ORR), were identified during previous RFI activities conducted at SWMU 7. Munitions used at all of these closed ranges consisted of small arms. During a preliminary site visit by Tetra Tech NUS, Inc. (TtNUS), no visual munitions and explosives of concern (MEC) were observed, and based on the nature of the site operation, MEC is not suspected to be present. Munitions constituents (MCs) that are present consisted of metals (primarily lead and to a lesser extent antimony, arsenic, copper, zinc, and tin) and polynuclear aromatic hydrocarbons (PAHs) from clay targets at the skeet and trap ranges. Contamination present at the site was located in surface soil. Site features and approximate boundaries for the individual sites that make up UXO 7 are presented on Figure 2-1.

It is believed that the Navy routinely removed the top portions of the berms at the target areas to remove any possible lead bullets\fragments to avoid ricocheting and replace with fresh soil.

For purposes of the human health and ecological risk assessments in Sections 6.0 and 7.0, respectively, UXO 7 will be discussed as three distinct zones. The Northern Zone (500- and 400-yard firing positions and dirt mound), the Central Zone (300-, 200-, and 100-yard firing positions and former East and West Trap Ranges), and the Southern Zone (main targets and barricade, hillside impact area, and former South Pistol Range).

1.4 SELECTION OF CHEMICALS OF CONCERN

The chemicals of concern (COCs) for the RFI were selected based on the known uses of the site as a former rifle and pistol range and trap and skeet ranges and include lead and PAHs.

1.5 SITE PHYSICAL CHARACTERISTICS

The physical characteristics of the site are discussed in Sections 1.4.2 through 1.4.6 of the Quality Assurance Project Plan (QAPP) (TtNUS, 2004).

1.6 SCOPE OF WORK

The field investigation was conducted to identify COCs (i.e., metals and PAHs) that may exist as a result of past operations at the site. If contaminants are present at concentrations posing a risk to human or ecological receptors, further investigation may be warranted. Surface soil samples [0 to 2 feet below ground surface (bgs)] were collected within the individual areas at the site.

Because surface water and sediment associated with the nearby Turkey Creek had previously been investigated, no sampling of these media occurred during this RFI.

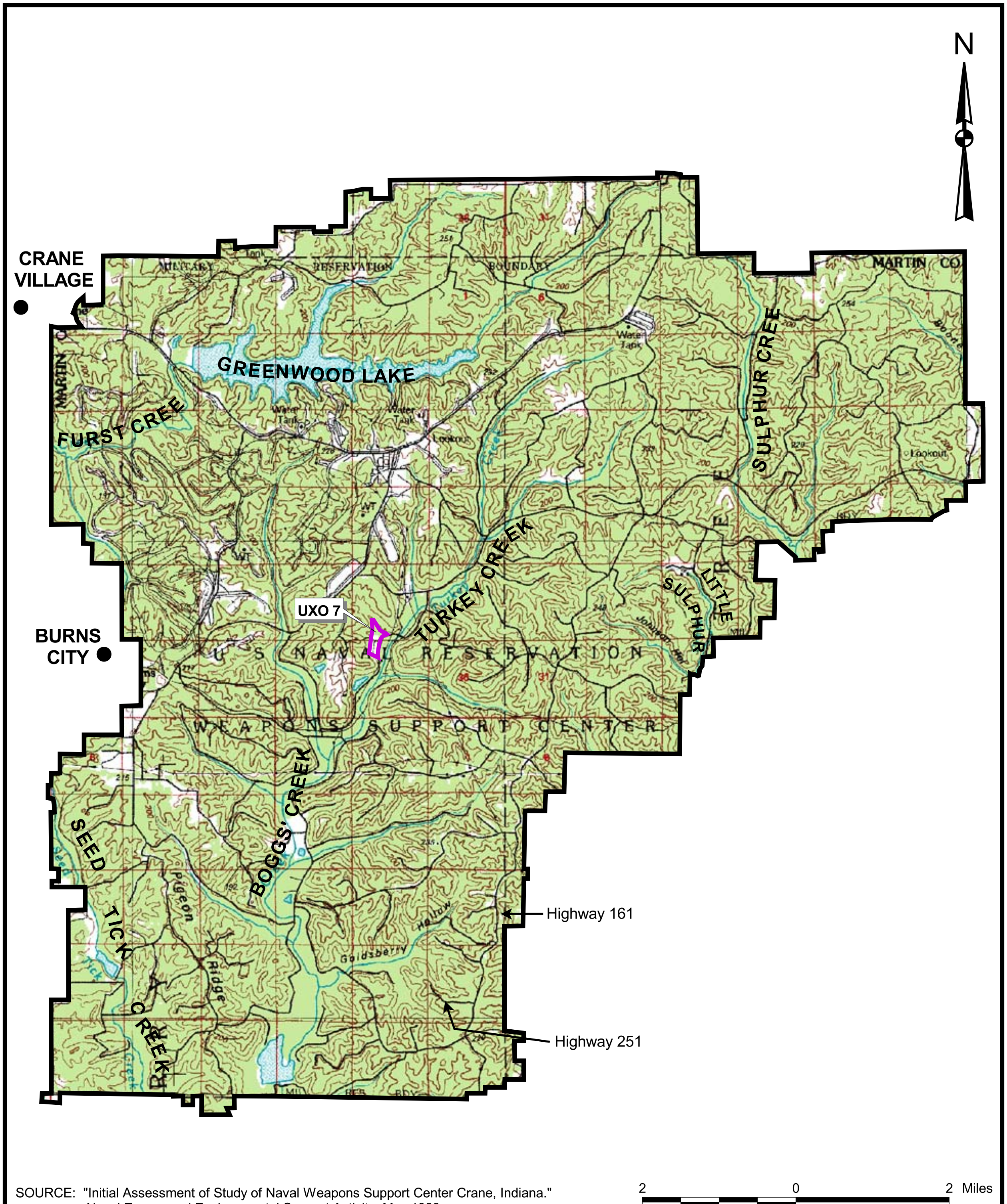
1.7 REPORT ORGANIZATION

The following sections are presented in the remainder of this document:

- Section 2.0: Field Investigation
- Section 3.0: Data Report/Data Quality Review
- Section 4.0: Nature and Extent and COPC Selection
- Section 5.0: Chemical Fate and Transport Analysis
- Section 6.0: Human Health Risk Assessment
- Section 7.0: Ecological Risk Assessment
- Section 8.0: Conclusions and Recommendations

DRAWN BY J. LAMEY — DATE 3/09/00	NAVFAC	GENERAL LOCATION MAP	CONTRACT NUMBER CTO 0006
CHECKED BY C. RUMER — DATE 9/22/08		UXO 7 - RFI REPORT	APPROVED BY — DATE
COST/SCHEDULE-AREA		NSWC CRANE	APPROVED BY — DATE
SCALE AS NOTED		CRANE, INDIANA	DRAWING NO. FIGURE 1 - 1 — REV 0

P:\GIS\NSWC_CRANE\APR\0087.APR GENERAL LOCATION MAP 9/19/08 SS



SOURCE: "Initial Assessment of Study of Naval Weapons Support Center Crane, Indiana." Naval Energy and Environmental Support Activity, May 1983.

DRAWN BY J. LAMEY	DATE 8/27/01	CONTRACT NUMBER CTO 0006
CHECKED BY C. RUMER	DATE 09/22/08	APPROVED BY — DATE —
COST/SCHEDULE-AREA		APPROVED BY — DATE —
SCALE AS NOTED		DRAWING NO. 1 - 2 REV 0

SITE LOCATION
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

P:\GIS\CRANE_NSWC\SURFICIALCSMR.APR UXO LOCATION LAYOUT 09/22/08 SS

2.0 FIELD INVESTIGATION

This section describes the sampling activities, procedures, and documentation utilized during the field activities performed in October 2007 at NSWC Crane, UXO 7.

2.1 OVERVIEW

UXO 7 is an area at NSWC Crane located within SWMU 7 that contains three closed ranges, the East Trap Range, the West Trap Range, and the South Pistol Range. A fourth area located within SWMU 7 is the closed ORR, including its Main Target Area and associated shooting lanes. Because lead had not previously been investigated at the ORR, this closed range was also incorporated into the UXO 7 field investigation. All samples during the UXO 7 RFI were collected by hand auger from 0 to 2 feet bgs (see Table 2-1). All soil samples were analyzed in the field for lead via X-Ray Fluorescence (XRF). Metals analysis at a fixed-base laboratory was conducted on select samples within each of the four investigative areas at UXO 7. PAH analysis at a fixed-base laboratory was conducted only on samples collected from the East and West Trap Ranges because clay targets were only used within these two areas. Table 2-2 summarizes which samples were selected for fixed-base laboratory analysis.

All work performed for this field investigation was conducted in accordance with the procedures and methodologies described in the United States Environmental Protection Agency (U.S. EPA)-approved QAPP Addendum No. 2 (TtNUS, 2007). Standard Operating Procedures (SOPs) that governed the field work are included in Appendix A of the approved QAPP. Sample log sheets, field documentation, photographs, and other supporting documentation associated with this field investigation are provided in Appendices A through F of this document.

2.2 MOBILIZATION/DEMOBILIZATION

Following approval of the QAPP, TtNUS personnel began mobilization activities on October 1, 2007. All field team members reviewed the approved QAPP, associated appendices, and Health and Safety Plan (HASP) prior to the start of project activities. In addition, the Field Operations Leader (FOL) held a field team orientation meeting to ensure that personnel were familiar with the scope of the field activities.

Prior to the initiation of fieldwork, the FOL arrived at the site and began on-site mobilization activities. These activities included coordination with NSWC Crane personnel and utility clearance of all proposed boring locations through the Indiana Underground Plant Protection Service (IUPPS). The equipment required for the field activities was shipped to the site. At the conclusion of field activities, the FOL completed the decontamination and demobilization of all equipment.

2.3 SITE INVESTIGATION METHODOLOGIES AND PROCEDURES

2.3.1 Hand Augering

All borings at UXO 7 were completed by hand auger techniques during this field investigation. Hand augering involves manually turning a 2½-inch stainless steel auger bucket into the ground surface to the desired sample depth. All hand augered soil borings at UXO 7 were advanced to a maximum depth of 2 feet bgs unless refusal was encountered prior to that depth. If refusal was encountered at a depth less than 1 foot bgs, the auger was removed and repositioned nearby until a depth greater than 1 foot bgs was achieved. Upon reaching the desired depth, the soil from the boring was homogenized and a portion was then placed in a disposable plastic bag. The auger bucket was decontaminated in the field between each sample location as outlined in Section 2.9 and in accordance with SOP CTO0034-04.

2.3.2 XRF Analyses

All soil samples were processed in the field scanned for lead via a portable (XRF) analyzer in accordance with SOP CTO0034-07. Sample processing included homogenizing the soil sample, removing large rocks or other debris, crushing the sample to uniform size, and drying the sample in a convection oven. Three separate XRF measurements were made for each soil sample, and the reported concentration is the average value of those three readings (see Table 2-3). The sample baggie was thoroughly mixed in between each reading. U.S. EPA Region 9 media cleanup standard (MCS) of 400 milligrams per kilogram (mg/kg) for lead for residential land use was used as the decision criteria during the XRF screening process.

If the lead XRF result was less than the MCS of 400 mg/kg, no additional sample was collected in the vicinity of that sample location. If the average XRF concentration was greater than 400 mg/kg, additional soil samples were collected around that location until the extent of the contamination could be defined.

The XRF was standardized daily prior to analyzing samples and after every 4 hours of instrument use. An instrument blank was also analyzed at the beginning of each day and after every 20 samples to verify that no contamination existed in the spectrometer or on the probe. After each blank check, a calibration verification check sample was run to verify the accuracy of the instrument and to assess the stability and consistency of the analysis. All quality control (QC) documentation for the XRF analyzer is included in Appendix C of this document. The XRF analyzer malfunctioned late in the afternoon on October 7, 2007 while scanning sample X7SS1520002. The machine began making an unusual noise, and standardization of the analyzer could not be completed. A technician at the rental company was contacted on October 8, and it was his/her determination that the machine was malfunctioning and would need repair. A replacement analyzer was shipped over night and received at the site on the morning of October 9. No additional samples were analyzed with the original XRF unit, and the initial readings for sample X7SS1520002 were discarded and the sample was reanalyzed with the replacement unit.

Sample IDs, XRF data, and associated laboratory concentrations are presented in Table 2-3. All soil sample logs, QC logs, and chain-of-custody forms are included in Appendix A of this report.

2.3.3 Sample Logging

A soil sample log sheet was maintained for each sample collected during the UXO 7 RFI. The sample log sheets are included in Appendix A and contain the following information as appropriate:

- Sample location and sample ID
- Name of person(s) collecting the sample
- Sample depth, date, and time
- Brief soil description

2.4 SAMPLING OPERATIONS

This section discusses the methodology for soil sampling activities performed during the UXO 7 RFI.

Surface soil samples were collected from the ground surface to a maximum depth of 2 feet bgs or until refusal was reached using a hand auger. The approved QAPP Addendum No. 2 (TtNUS, 2007) proposed that a total of 171 soil samples be collected during this field investigation; however, due to delineation of sample locations where lead XRF concentrations exceeded 400 mg/kg, 189 samples were actually collected. Table 2-2 provides rationales for why proposed samples were not collected and why additional samples were collected. Sample ID X7SB172 was mistakenly not used; therefore, no associated XRF or laboratory data exist for that ID. See Figure 2-1 for all soil sample locations. During sample collection activities, all soil material was visually inspected in the field for the presence of bullets, lead shot (BBs), and clay pigeon remnants. The sample material was again visually monitored in the field laboratory while processing each sample for XRF analysis. Besides a few bullets observed at the top of the Main Target Area berm, no other bullet fragments or lead shot were observed within UXO 7. In addition to visually monitoring the soil at each sample location, the FOL visually inspected the first few inches of soil in several other areas between sample locations within UXO 7. This was done by removing the grass and sifting the soil while looking for possible bullet fragments, lead shot, and clay pigeon remnants. A single clay pigeon remnant was observed at the former East Trap Range as detailed further in Section 2.4.2.

The four ranges within UXO 7 are discussed below.

2.4.1 Old Rifle Range including Former Main Target Area and Associated Firing Berms and Firing Lanes

The ORR includes the main targets and berm, the hillside behind the main targets, the 100-, 200-, 300-, 400-, and 500-yard firing berms, the dirt mound located between the 300- and 400-yard berms, and the flat-lying shooting lanes between the firing berms.

Main Target and Barricade

Seven sample locations (X7SB001 through 007) were spatially placed throughout the berm directly in front of the main targets. This area would have been impacted by bullets falling short of the intended targets. Although all field XRF lead results for these samples were less than 400 mg/kg, three of the seven sample locations were selected for fixed-base laboratory analysis for Target Analyte List (TAL) metals based on the high probability of the area being impacted by lead bullets. Four bullets were found at the very top of the berm next to the concrete back wall.

Main Target Hillside Area

Thirteen sample locations (X7SB008 through 020) were positioned on this north-facing hillside based on field observations of areas within the highest probability of impact. All XRF lead results for these samples were less than 400 mg/kg. Two samples were selected for fixed-base laboratory analyses (TAL metals) for confirmation.

Firing Berms

All initial sample locations at each of the five firing berms [100-yard (X7SB021 to 026), 200-yard (X7SB027 to 031), 300-yard (X7SB032 to 037), 400-yard (X7SB043 to 048), and 500-yard (X7SB049 to 052)] were positioned along the top of each berm because this is the area where the shooting activity would have most likely taken place. All field XRF lead screening results at the 100-, 200-, 300-, and 500-yard firing berms were significantly less than 400 mg/kg; therefore, no samples from any of the firing berms were selected for fixed-base laboratory analysis.

At the 400-yard firing berm, six samples were initially collected along the top of the berm. Sample locations X7SB045 and 046, in the central part of the berm, had average XRF lead concentrations of 562 and 701 mg/kg, respectively. Because locations to the west and east had lead concentrations less than 400 mg/kg, additional locations (X7SB177 to 182) were sampled approximately 10 feet to the north and south to determine the extent of the contamination. Average XRF lead concentrations for the additional samples were less than 400 mg/kg. To confirm the extent of lead contamination at the 400-yard firing berm, 10 of the 12 samples collected were selected for fixed-base laboratory analyses (TAL metals).

Dirt Mound

An oval-shaped dirt mound exists between the 300- and 400-yard firing berms (Figure 2-1). The height of the mound blocks the shooter's view of the Main Target Area from most locations on the 400- and 500-yard firing berms, confirming that the mound was placed there after the ORR was closed. Field observations indicate the dirt was placed on a layer of black plastic.

Five sample locations (X7SB038 to 042) were initially placed around and on this dirt mound. The average XRF lead concentration for sample X7SS0390002 was 382 mg/kg. Although this concentration was less than the MCS of 400 mg/kg, two additional samples (X7SS1830002 and X7SS1840002) were collected on either side of this location to ensure that additional lead contamination did not exist. The average XRF lead concentrations for the two additional samples were less than 30 mg/kg. Three of the seven samples collected were sent for fixed-base laboratory analysis.

Areas Between Firing Berms

To ensure that all areas associated with the shooting lanes at UXO 7 were investigated during this field event, additional samples (X7SB053 to 062) were located within the flat-lying areas between the firing berms as shown on Figure 2-1. Sample X7SS0550002, located halfway between the 400- and 500-yard firing berm, was the only sample from this group with an average XRF lead concentration greater than 400 mg/kg at 741 mg/kg. A duplicate sample was collected at this location, and the average XRF lead concentration for the duplicate was 1,014 mg/kg. Sample locations X7SB173 to 176 were then collected around location X7SB055 to delineate lead contamination. The XRF lead concentration at location X7SB174 was 442 mg/kg; therefore, two additional sample locations (X7SB189 and 190) were collected just to the northeast and southeast of location X7SB174. These samples had XRF lead concentrations of 166 and 335 mg/kg, respectively. To ensure that the area had been sufficiently delineated, samples from locations X7SB055, 173, 174, 175, and 189 were sent to the fixed-base laboratory for TAL metals analyses.

2.4.2 Former East Trap Range

Thirty-six sample locations (X7SB063 to 094 and X7SB185 to 188) were spatially placed in the area of the former East Trap Range. In the QAPP Addendum No. 2 (TtNUS, 2007), the former East Trap Range was presented as being located in the central portion of SWMU 7 on both sides of the gravel road bisecting the SWMU. Prior to sampling the former East Trap Range, the Navy presented TtNUS with a 1952 aerial photograph of SWMU 7 showing the actual location of the former East Trap Range east of the bisecting gravel road. Therefore, the sampling plan was shifted to the east to cover this area. While walking through the grass in this area during sampling activities, a depression was observed that contained broken concrete and rebar. This was presumed to be the location of a small concrete building that was used as the launching area for the clay pigeons, with the shooters standing just south of the building and firing to the north. The location of the concrete and rebar is marked by sample location X7SB067. A nickel-sized piece of a clay pigeon was observed in surface soil at location X7SB075, further indicating that sampling was being conducted in the correct area. Each sample within the former East Trap Range was scanned with the XRF, and the maximum lead concentration was 51 mg/kg.

Five sample locations within the former East Trap Range were selected for fixed-base laboratory analyses including TAL metals and PAHs. These sample locations were selected from areas that were thought to have the most fall-out from hit clay pigeons.

2.4.3 Former West Trap Range

Forty-seven sample locations (X7SB095 to 141) were placed in the area of the former West Trap Range. The trap range faces a line of trees, and the majority of samples were collected in the area leading up to this tree line. Ten samples were collected up to 100 feet inside the tree line with the assumption that most shot would have fallen to the ground within this distance after coming into contact with the trees.

As with the East Trap Range, samples from all locations were scanned with the XRF, and the maximum lead concentration was 60 mg/kg. Six samples were selected for fixed-base laboratory PAH analyses, and one sample was selected for fixed-base laboratory TAL metals analyses.

2.4.4 Former South Pistol Range

Thirty sample locations (X7SB142 to 171) were placed in the area of the former South Pistol Range. The 1952 aerial photograph mentioned in Section 2.4.2 shows a backstop (earthen berm) along the northern edge of the gravel road that enters UXO 7 from the east as depicted on Figure 2-1. This berm no longer exists, and a retention pond has been dug just northeast of the range. The southwestern corner of the retention pond actually encompasses part of the former Pistol Range. Samples were not collected in this area since excavation and fill associated with the retention pond had occurred in this area.

Seventeen samples were collected in the area of the presumed firing lanes and the former earthen berm at the former Pistol Range. South of the gravel road, seven samples were located just north of the tree line, and six samples were collected approximately 15 feet inside this tree line.

All average XRF lead concentrations were less than 400 mg/kg. Three samples within the former South Pistol Range were selected for fixed-base laboratory analyses (TAL metals).

2.5 FIELD SAMPLE DOCUMENTATION

Sample documentation consisted of the completion of sample log sheets, chain-of-custody records, field logbooks, and health and safety documentation. Field documentation was completed as per SOP CTO0034-03. The sample log sheets contain information such as sample location and sample identification number, container requirements and analyses to be performed, and sample type, time, and date. Any unusual circumstances encountered during sample collection were noted on the form. Sample log sheets can be found in Appendix A of this document. Chain-of-custody forms (see Appendix A) were used to track each sample from collection to receipt and analysis at the fixed-base laboratory.

2.6 SAMPLE HANDLING, PACKAGING, AND SHIPPING

Sample handling activities included field-related considerations concerning the selection of sample containers, allowable holding times, sample custody, and maintaining samples at the appropriate storage temperature. All sample containers shipped to the fixed-base laboratory were sealed in plastic bags to minimize the possibility of breakage during transport. The sample containers were then placed in a cooler lined with a large plastic garbage bag and covered with ice. A temperature blank was placed in each cooler prior to shipment. The plastic garbage bag was sealed with a knot, and the chain-of-custody form was sealed in a Ziploc® bag and taped to the inside of the cooler lid. A signed and dated custody seal was applied to each end of the cooler and then covered with strapping tape to provide a tamper-evident seal. A Federal Express® airbill was applied to the shipping cooler. TtNUS maintained custody of the samples until they were relinquished to Federal Express®. The Federal Express® tracking number (airbill number) was recorded on the chain-of-custody form, and the sender's copy of the airbill was maintained for shipment tracking, if needed. All samples were shipped to the laboratory for overnight delivery and were received within sample holding times.

2.7 QUALITY CONTROL SAMPLES

Quality assurance (QA)/QC samples were generated and collected during sampling activities to monitor both field and laboratory procedures, in accordance with the approved QAPP (TtNUS, 2007). QC for the XRF analyzer is detailed in Section 2.3.2 of this document. QA/QC samples included field duplicates, equipment rinsate blanks, and temperature blanks. Field duplicate results are tabulated in Appendix C of this document. Types of QA/QC samples are briefly described as follows:

- Field Duplicates - consisted of a single sample split into two portions. Field duplicates were collected at the rate of 1 in 20 during this field investigation to assess the overall precision of the sampling and analysis program. XRF duplicate samples are shown in Table 2-3 and are denoted with a –D after the sample ID.

- Equipment Rinsate Blanks - obtained under representative field conditions by collecting the rinse water generated by running analyte-free water through or over sample collection equipment after decontamination and before use. When pre-cleaned, dedicated, or disposable sampling equipment was used (no decontamination was required), one equipment rinsate blank was collected as a batch blank. Equipment rinsate blanks were analyzed for the same chemical constituents as the associated environmental samples.

- Temperature blanks - used to determine if samples were adequately cooled during shipment. Temperature blanks consisted of analyte-free water poured into a clean sample container at the site or supplied by the fixed-based laboratory. One temperature blank was submitted to the laboratory in each cooler, and the temperature was checked upon receipt at the laboratory.

2.8 GPS

Each sample location at UXO 7 was marked with a brightly covered pin flag pushed into the ground next to the boring. Northing and easting coordinates for each sample location were then logged by TtNUS personnel utilizing a Trimble XT Global Positioning System (GPS) unit. This information is retained in the

TtNUS main database and can be used as a reference if repeat sampling is required at any of the sample locations.

2.9 DECONTAMINATION

The non-dedicated, non-disposable equipment (i.e., hand auger) involved in field sampling activities was decontaminated before beginning work, between sample locations, and at the completion of field activities in accordance with SOP CTO034-04.

The following decontamination steps were taken:

- Potable water and phosphate-free detergent wash (scrub if necessary)
- Potable water rinse
- Deionized (DI) water rinse
- Air dry (if possible)
- Wrap in aluminum foil (if not used immediately)

2.10 INVESTIGATION-DERIVED WASTE HANDLING

The field investigation generated potentially contaminated wastes including personal protective equipment (PPE) and decontamination fluids. Management of each residue was performed as follows:

PPE – All PPE were double bagged and placed in NSWC Crane trash receptacles (i.e., dumpsters).

Sampling Equipment Decontamination Fluids – All equipment decontamination fluids were collected and discharged to the NSWC Crane permitted waste treatment plant.

All soil removed from a sample location that was not used as part of that sample was returned to its original boring.

2.11 SITE MANAGEMENT AND FACILITY SUPPORT

The FOL was designated as the lead in coordinating all day-to-day activities during the investigation. The FOL was responsible for ensuring that all field team members (including subcontractors) were familiar with the approved QAPP and the HASP in effect during this field investigation. Additionally, the FOL was responsible for all sampling operations, QA/QC, field documentation requirements, and field change orders. The FOL reported to the Task Order Manager (TOM) on a daily basis regarding the status of fieldwork.

All site preparation, mobilization/demobilization, and sampling activities were coordinated through NSWC Crane personnel through pre-visit communication and meetings during the field work.

2.12 RECORDKEEPING

Electronic records were maintained for the daily activities that took place during this field investigation. Other records including sample log sheets and chain-of-custody forms were completed in accordance with SOP CTO034-03. Information recorded daily included field activities, weather conditions, identity and arrival and departure times of personnel, management issues, etc. Copies of daily activity records are included in Appendix A.

TABLE 2-1

BORING DATES, DEPTHS, METHOD, AND INTERVALS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Boring No.	Total Depth (feet bgs)	Drilling Method(1)	Date Drilled	Depth Interval of Soil Sample (feet bgs)
X7SS001	2.0	HA	2-Oct-07	0-2
X7SS002	2.0	HA	2-Oct-07	0-2
X7SS003	2.0	HA	2-Oct-07	0-2
X7SS004	2.0	HA	2-Oct-07	0-2
X7SS005	2.0	HA	2-Oct-07	0-2
X7SS006	2.0	HA	2-Oct-07	0-2
X7SS007	2.0	HA	2-Oct-07	0-2
X7SS008	2.0	HA	2-Oct-07	0-2
X7SS009	2.0	HA	2-Oct-07	0-2
X7SS010	2.0	HA	2-Oct-07	0-2
X7SS011	2.0	HA	2-Oct-07	0-2
X7SS012	2.0	HA	2-Oct-07	0-2
X7SS013	2.0	HA	2-Oct-07	0-2
X7SS014	2.0	HA	2-Oct-07	0-2
X7SS015	2.0	HA	2-Oct-07	0-2
X7SS016	2.0	HA	2-Oct-07	0-2
X7SS017	2.0	HA	2-Oct-07	0-2
X7SS018	2.0	HA	2-Oct-07	0-2
X7SS019	2.0	HA	2-Oct-07	0-2
X7SS020	2.0	HA	2-Oct-07	0-2
X7SS021	2.0	HA	3-Oct-07	0-2
X7SS022	2.0	HA	3-Oct-07	0-2
X7SS023	2.0	HA	3-Oct-07	0-2
X7SS024	2.0	HA	3-Oct-07	0-2
X7SS025	2.0	HA	3-Oct-07	0-2
X7SS026	2.0	HA	3-Oct-07	0-2
X7SS027	2.0	HA	3-Oct-07	0-2
X7SS028	2.0	HA	3-Oct-07	0-2
X7SS029	2.0	HA	3-Oct-07	0-2
X7SS030	2.0	HA	3-Oct-07	0-2
X7SS031	2.0	HA	3-Oct-07	0-2
X7SS032	2.0	HA	3-Oct-07	0-2
X7SS033	2.0	HA	3-Oct-07	0-2
X7SS034	2.0	HA	3-Oct-07	0-2
X7SS035	2.0	HA	3-Oct-07	0-2
X7SS036	2.0	HA	3-Oct-07	0-2
X7SS037	2.0	HA	3-Oct-07	0-2
X7SS038	2.0	HA	3-Oct-07	0-2
X7SS039	2.0	HA	3-Oct-07	0-2
X7SS040	2.0	HA	3-Oct-07	0-2

TABLE 2-1

BORING DATES, DEPTHS, METHOD, AND INTERVALS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Boring No.	Total Depth (feet bgs)	Drilling Method[1]	Date Drilled	Depth Interval of Soil Sample (feet bgs)
X7SS041	2.0	HA	3-Oct-07	0-2
X7SS042	2.0	HA	3-Oct-07	0-2
X7SS043	2.0	HA	3-Oct-07	0-2
X7SS044	2.0	HA	3-Oct-07	0-2
X7SS045	2.0	HA	3-Oct-07	0-2
X7SS046	2.0	HA	3-Oct-07	0-2
X7SS047	2.0	HA	3-Oct-07	0-2
X7SS048	2.0	HA	3-Oct-07	0-2
X7SS049	2.0	HA	3-Oct-07	0-2
X7SS050	2.0	HA	3-Oct-07	0-2
X7SS051	2.0	HA	3-Oct-07	0-2
X7SS052	2.0	HA	3-Oct-07	0-2
X7SS053	2.0	HA	4-Oct-07	0-2
X7SS054	2.0	HA	4-Oct-07	0-2
X7SS055A[2]	1.0	HA	6-Oct-07	0-1
X7SS055B[2]	2.0	HA	4-Oct-07	0-2
X7SS056	2.0	HA	4-Oct-07	0-2
X7SS057	2.0	HA	4-Oct-07	0-2
X7SS058A[2]	2.0	HA	6-Oct-07	0-2
X7SS058B[2]	2.0	HA	4-Oct-07	0-2
X7SS059	2.0	HA	4-Oct-07	0-2
X7SS060	2.0	HA	4-Oct-07	0-2
X7SS061	2.0	HA	4-Oct-07	0-2
X7SS062	2.0	HA	4-Oct-07	0-2
X7SS063	2.0	HA	4-Oct-07	0-2
X7SS064	2.0	HA	4-Oct-07	0-2
X7SS065	2.0	HA	4-Oct-07	0-2
X7SS066	2.0	HA	4-Oct-07	0-2
X7SS067	2.0	HA	4-Oct-07	0-2
X7SS068	2.0	HA	4-Oct-07	0-2
X7SS069	2.0	HA	5-Oct-07	0-2
X7SS070	2.0	HA	9-Oct-07	0-2
X7SS071	2.0	HA	5-Oct-07	0-2
X7SS072	2.0	HA	4-Oct-07	0-2
X7SS073	2.0	HA	5-Oct-07	0-2
X7SS074	2.0	HA	5-Oct-07	0-2
X7SS075	2.0	HA	5-Oct-07	0-2
X7SS076	2.0	HA	5-Oct-07	0-2
X7SS077	2.0	HA	5-Oct-07	0-2

TABLE 2-1

BORING DATES, DEPTHS, METHOD, AND INTERVALS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Boring No.	Total Depth (feet bgs)	Drilling Method[1]	Date Drilled	Depth Interval of Soil Sample (feet bgs)
X7SS078	2.0	HA	5-Oct-07	0-2
X7SS079	2.0	HA	5-Oct-07	0-2
X7SS080	2.0	HA	5-Oct-07	0-2
X7SS081	2.0	HA	5-Oct-07	0-2
X7SS082	2.0	HA	5-Oct-07	0-2
X7SS083	2.0	HA	5-Oct-07	0-2
X7SS084	2.0	HA	5-Oct-07	0-2
X7SS085	2.0	HA	5-Oct-07	0-2
X7SS086	2.0	HA	5-Oct-07	0-2
X7SS087	2.0	HA	5-Oct-07	0-2
X7SS088	2.0	HA	5-Oct-07	0-2
X7SS089	2.0	HA	5-Oct-07	0-2
X7SS090	2.0	HA	5-Oct-07	0-2
X7SS091	2.0	HA	5-Oct-07	0-2
X7SS092	2.0	HA	5-Oct-07	0-2
X7SS093	2.0	HA	5-Oct-07	0-2
X7SS094	2.0	HA	5-Oct-07	0-2
X7SS095	2.0	HA	6-Oct-07	0-2
X7SS096	2.0	HA	6-Oct-07	0-2
X7SS097	2.0	HA	7-Oct-07	0-2
X7SS098	2.0	HA	7-Oct-07	0-2
X7SS099	2.0	HA	6-Oct-07	0-2
X7SS100	2.0	HA	6-Oct-07	0-2
X7SS101	2.0	HA	6-Oct-07	0-2
X7SS102	2.0	HA	6-Oct-07	0-2
X7SS103	2.0	HA	6-Oct-07	0-2
X7SS104	2.0	HA	6-Oct-07	0-2
X7SS105	2.0	HA	6-Oct-07	0-2
X7SS106	2.0	HA	6-Oct-07	0-2
X7SS107	2.0	HA	9-Oct-07	0-2
X7SS108	2.0	HA	9-Oct-07	0-2
X7SS109	2.0	HA	9-Oct-07	0-2
X7SS110	2.0	HA	6-Oct-07	0-2
X7SS111	2.0	HA	6-Oct-07	0-2
X7SS112	2.0	HA	6-Oct-07	0-2
X7SS113	2.0	HA	6-Oct-07	0-2
X7SS114	2.0	HA	6-Oct-07	0-2
X7SS115	2.0	HA	6-Oct-07	0-2
X7SS116	2.0	HA	6-Oct-07	0-2
X7SS117	2.0	HA	6-Oct-07	0-2

TABLE 2-1

BORING DATES, DEPTHS, METHOD, AND INTERVALS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Boring No.	Total Depth (feet bgs)	Drilling Method(1)	Date Drilled	Depth Interval of Soil Sample (feet bgs)
X7SS118	2.0	HA	6-Oct-07	0-2
X7SS119	2.0	HA	7-Oct-07	0-2
X7SS120	2.0	HA	6-Oct-07	0-2
X7SS121	2.0	HA	6-Oct-07	0-2
X7SS122	2.0	HA	6-Oct-07	0-2
X7SS123	2.0	HA	6-Oct-07	0-2
X7SS124	2.0	HA	6-Oct-07	0-2
X7SS125	2.0	HA	6-Oct-07	0-2
X7SS126	2.0	HA	7-Oct-07	0-2
X7SS127	2.0	HA	7-Oct-07	0-2
X7SS128	2.0	HA	6-Oct-07	0-2
X7SS129	2.0	HA	6-Oct-07	0-2
X7SS130	2.0	HA	6-Oct-07	0-2
X7SS131	2.0	HA	6-Oct-07	0-2
X7SS132	2.0	HA	6-Oct-07	0-2
X7SS133	2.0	HA	6-Oct-07	0-2
X7SS134	2.0	HA	6-Oct-07	0-2
X7SS135	2.0	HA	6-Oct-07	0-2
X7SS136	2.0	HA	6-Oct-07	0-2
X7SS137	2.0	HA	6-Oct-07	0-2
X7SS138	2.0	HA	6-Oct-07	0-2
X7SS139	2.0	HA	6-Oct-07	0-2
X7SS140	2.0	HA	6-Oct-07	0-2
X7SS141	2.0	HA	6-Oct-07	0-2
X7SS142	2.0	HA	7-Oct-07	0-2
X7SS143	2.0	HA	7-Oct-07	0-2
X7SS144	2.0	HA	7-Oct-07	0-2
X7SS145	2.0	HA	7-Oct-07	0-2
X7SS146	2.0	HA	7-Oct-07	0-2
X7SS147	2.0	HA	7-Oct-07	0-2
X7SS148	2.0	HA	7-Oct-07	0-2
X7SS149	2.0	HA	7-Oct-07	0-2
X7SS150	2.0	HA	7-Oct-07	0-2
X7SS151	2.0	HA	7-Oct-07	0-2
X7SS152	2.0	HA	7-Oct-07	0-2
X7SS153	2.0	HA	7-Oct-07	0-2
X7SS154	2.0	HA	7-Oct-07	0-2
X7SS155	2.0	HA	7-Oct-07	0-2
X7SS156	2.0	HA	7-Oct-07	0-2
X7SS157	2.0	HA	7-Oct-07	0-2

TABLE 2-1

BORING DATES, DEPTHS, METHOD, AND INTERVALS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Boring No.	Total Depth (feet bgs)	Drilling Method(1)	Date Drilled	Depth Interval of Soil Sample (feet bgs)
X7SS158	2.0	HA	7-Oct-07	0-2
X7SS159	2.0	HA	7-Oct-07	0-2
X7SS160	2.0	HA	7-Oct-07	0-2
X7SS161	2.0	HA	7-Oct-07	0-2
X7SS162	2.0	HA	7-Oct-07	0-2
X7SS163	2.0	HA	7-Oct-07	0-2
X7SS164	2.0	HA	7-Oct-07	0-2
X7SS165	2.0	HA	7-Oct-07	0-2
X7SS166	2.0	HA	7-Oct-07	0-2
X7SS167	1.0	HA	7-Oct-07	0-1
X7SS168	1.0	HA	7-Oct-07	0-1
X7SS169	1.0	HA	7-Oct-07	0-1
X7SS170	1.0	HA	7-Oct-07	0-1
X7SS171	2.0	HA	7-Oct-07	0-2
X7SS172	No Sample Collected			
X7SS173	2.0	HA	7-Oct-07	0-2
X7SS174	1.0	HA	7-Oct-07	0-1
X7SS175	1.0	HA	7-Oct-07	0-1
X7SS176	1.0	HA	7-Oct-07	0-1
X7SS177	2.0	HA	7-Oct-07	0-2
X7SS178	2.0	HA	7-Oct-07	0-2
X7SS179	2.0	HA	7-Oct-07	0-2
X7SS180	2.0	HA	7-Oct-07	0-2
X7SS181	2.0	HA	7-Oct-07	0-2
X7SS182	2.0	HA	7-Oct-07	0-2
X7SS183	2.0	HA	7-Oct-07	0-2
X7SS184	2.0	HA	7-Oct-07	0-2
X7SS185	2.0	HA	9-Oct-07	0-2
X7SS186	2.0	HA	9-Oct-07	0-2
X7SS187	2.0	HA	9-Oct-07	0-2
X7SS188	2.0	HA	9-Oct-07	0-2
X7SS189	2.0	HA	9-Oct-07	0-2
X7SS190	2.0	HA	9-Oct-07	0-2

1 HA - hand auger.
2 It was suspected that the initial samples collected at locations X7SB55 and X7SB58 (X7SS55B and X7SS58B) were mislabeled; therefore, additional samples (X7SS55A and X7SS58A) were subsequently collected at those locations.
bgs - Below ground surface.

TABLE 2-2

SAMPLE SUMMARY TABLE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Sample Number	Metals		PAHs	Comment
	SW-846 3050B/6020 (TAL Metals)	Field XRF (Lead Only)	SW-846 8270C	
X7SS001	---	X	---	
X7SS002	X	X	---	
X7SS003	X	X	---	
X7SS004	X	X	---	
X7SS005	---	X	---	
X7SS006	---	X	---	
X7SS007	---	X	---	
X7SS008	---	X	---	
X7SS009	---	X	---	
X7SS010	---	X	---	
X7SS011	---	X	---	
X7SS012	X	X	---	
X7SS013	---	X	---	
X7SS014	---	X	---	
X7SS015	---	X	---	
X7SS016	---	X	---	
X7SS017	---	X	---	
X7SS018	---	X	---	
X7SS019	X	X	---	
X7SS020	---	X	---	
X7SS021	---	X	---	
X7SS022	---	X	---	
X7SS023	---	X	---	
X7SS024	---	X	---	
X7SS025	---	X	---	
X7SS026	---	X	---	
X7SS027	---	X	---	
X7SS028	---	X	---	
X7SS029	---	X	---	
X7SS030	---	X	---	
X7SS031	---	X	---	
X7SS032	---	X	---	
X7SS033	---	X	---	
X7SS034	---	X	---	
X7SS035	---	X	---	
X7SS036	---	X	---	
X7SS037	---	X	---	
X7SS038	---	X	---	
X7SS039	X	X	---	
X7SS040	---	X	---	
X7SS041	---	X	---	
X7SS042	---	X	---	
X7SS043	---	X	---	
X7SS044	X	X	---	
X7SS045	X	X	---	
X7SS046	X	X	---	
X7SS047	---	X	---	
X7SS048	X	X	---	
X7SS049	---	X	---	
X7SS050	---	X	---	
X7SS051	---	X	---	

TABLE 2-2

SAMPLE SUMMARY TABLE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Sample Number	Metals		PAHs	Comment
	SW-846 3050B/6020 (TAL Metals)	Field XRF (Lead Only)	SW-846 8270C	
X7SS052	---	X	---	
X7SS053	---	X	---	
X7SS054	---	X	---	
X7SS055	X	X	---	
X7SS056	---	X	---	
X7SS057	---	X	---	
X7SS058	---	X	---	
X7SS059	---	X	---	
X7SS060	---	X	---	
X7SS061	---	X	---	
X7SS062	---	X	---	
X7SS063	---	X	---	
X7SS064	---	X	---	
X7SS065	---	X	---	
X7SS066	X	X	---	
X7SS067	---	X	---	
X7SS068	---	X	---	
X7SS069	---	X	---	
X7SS070	---	X	---	
X7SS071	---	X	X	
X7SS072	---	X	---	
X7SS073	---	X	---	
X7SS074	---	X	---	
X7SS075	X	X	X	
X7SS076	---	X	---	
X7SS077	---	X	---	
X7SS078	---	X	---	
X7SS079	---	X	X	
X7SS080	---	X	---	
X7SS081	---	X	X	
X7SS082	---	X	---	
X7SS083	---	X	---	
X7SS084	---	X	---	
X7SS085	---	X	---	
X7SS086	---	X	X	
X7SS087	---	X	---	
X7SS088	---	X	---	
X7SS089	---	X	---	
X7SS090	---	X	---	
X7SS091	---	X	---	
X7SS092	---	X	---	
X7SS093	---	X	---	
X7SS094	---	X	---	
X7SS095	---	X	---	
X7SS096	---	X	---	
X7SS097	---	X	---	
X7SS098	---	X	---	
X7SS099	---	X	---	
X7SS100	---	X	---	
X7SS101	---	X	---	
X7SS102	---	X	---	

TABLE 2-2

SAMPLE SUMMARY TABLE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Sample Number	Metals		PAHs	Comment
	SW-846 3050B/6020 (TAL Metals)	Field XRF (Lead Only)	SW-846 8270C	
X7SS103	---	X	---	
X7SS104	---	X	---	
X7SS105	---	X	---	
X7SS106	---	X	---	
X7SS107	---	X	---	
X7SS108	---	X	---	
X7SS109	---	X	---	
X7SS110	---	X	---	
X7SS111	---	X	---	
X7SS112	---	X	---	
X7SS113	---	X	---	
X7SS114	---	X	---	
X7SS115	---	X	---	
X7SS116	---	X	X	
X7SS117	---	X	---	
X7SS118	---	X	---	
X7SS119	---	X	---	
X7SS120	---	X	---	
X7SS121	---	X	X	
X7SS122	---	X	X	
X7SS123	---	X	X	
X7SS124	---	X	---	
X7SS125	---	X	---	
X7SS126	---	X	---	
X7SS127	X	X	---	
X7SS128	---	X	---	
X7SS129	---	X	X	
X7SS130	---	X	---	
X7SS131	---	X	---	
X7SS132	---	X	---	
X7SS133	---	X	---	
X7SS134	---	X	---	
X7SS135	---	X	---	
X7SS136	---	X	X	
X7SS137	---	X	---	
X7SS138	---	X	---	
X7SS139	---	X	---	
X7SS140	---	X	---	
X7SS141	---	X	---	
X7SS142	---	X	---	
X7SS143	---	X	---	
X7SS144	---	X	---	
X7SS145	---	X	---	
X7SS146	---	X	---	
X7SS147	---	X	---	
X7SS148	X	X	---	
X7SS149	---	X	---	
X7SS150	---	X	---	
X7SS151	---	X	---	
X7SS152	X	X	---	
X7SS153	---	X	---	

TABLE 2-2

SAMPLE SUMMARY TABLE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Sample Number	Metals		PAHs	Comment
	SW-846 3050B/6020 (TAL Metals)	Field XRF (Lead Only)	SW-846 8270C	
X7SS154	---	X	---	
X7SS155	---	X	---	
X7SS156	---	X	---	
X7SS157	---	X	---	
X7SS158	---	X	---	
X7SS159	---	X	---	
X7SS160	---	X	---	
X7SS161	---	X	---	
X7SS162	---	X	---	
X7SS163	---	X	---	
X7SS164	---	X	---	
X7SS165	---	X	---	
X7SS166	---	X	---	
X7SS167	X	X	---	
X7SS168	---	X	---	
X7SS169	---	X	---	
X7SS170	---	X	---	
X7SS171	---	X	---	
X7SS172	NA	NA	---	Sample number overlooked in the field and therefore not used
X7SS173	X	X	---	Sample location added to delineate location X7SB55
X7SS174	X	X	---	
X7SS175	X	X	---	
X7SS176	---	X	---	
X7SS177	X	X	---	Sample location added to delineate location X7SB46
X7SS178	X	X	---	
X7SS179	X	X	---	
X7SS180	X	X	---	
X7SS181	X	X	---	
X7SS182	X	X	---	
X7SS183	X	X	---	Sample location added to delineate location X7SB39
X7SS184	X	X	---	
X7SS185	---	X	---	Sample outer limits of East Trap Range
X7SS186	---	X	---	
X7SS187	---	X	---	
X7SS188	---	X	---	
X7SS189	X	X	---	Sample location added to delineate location X7SB174
X7SS190	---	X	---	
SURFACE SOIL TOTAL	**29**	**189**	**11**	

X = Sample was collected and analyzed as proposed.
NA = Not applicable.

TABLE 2-3

SUMMARY OF SOIL SAMPLE LEAD RESULTS (XRF AND FIXED-BASE LABORATORY)
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA
PAGE 1 OF 6

SAMPLE LOCATION	SAMPLE ID	SAMPLE DATE	LEAD RESULTS (ppm) XRF 1	2	3	AVERAGE OF POSITIVE HITS	LABORATORY ANALYSES (LEAD) (ppm)	SAMPLE AREA
X7SB001	X7SS0010002	10/2/2007	49	50	<28	50	NA	Main Target Area: Berm in front of main targets
X7SB002	X7SS0020002	10/2/2007	70	49	64	61	22.8	
X7SB003	X7SS0030002	10/2/2007	68	114	123	102	140	
X7SB004	X7SS0040002	10/2/2007	431	166	165	254	125	
X7SB005	X7SS0050002	10/2/2007	59	133	31	74	NA	
X7SB006	X7SS0060002	10/2/2007	<27	<23	<23	NA	NA	
X7SB006	X7SS0060002D	10/2/2007	38	<26	<27	38	NA	
X7SB007	X7SS0070002	10/2/2007	<27	<25	<26	NA	NA	
X7SB008	X7SS0080002	10/2/2007	37	35	55	42	NA	Main Target Area: Hillside behind main targets
X7SB009	X7SS0090002	10/2/2007	55	51	35	47	NA	
X7SB009	X7SS0090002D	10/2/2007	70	98	82	83	NA	
X7SB010	X7SS0100002	10/2/2007	76	96	94	89	NA	
X7SB011	X7SS0110002	10/2/2007	<27	<26	<27	NA	NA	
X7SB012	X7SS0120002	10/2/2007	48	39	50	46	43.9	
X7SB013	X7SS0130002	10/2/2007	54	50	45	50	NA	
X7SB014	X7SS0140002	10/2/2007	66	47	70	61	NA	
X7SB015	X7SS0150002	10/2/2007	36	37	41	38	NA	
X7SB016	X7SS0160002	10/2/2007	33	38	46	39	NA	
X7SB017	X7SS0170002	10/2/2007	43	48	57	49	NA	
X7SB018	X7SS0180002	10/2/2007	134	114	93	114	NA	
X7SB019	X7SS0190002	10/2/2007	280	203	283	255	537	
X7SB020	X7SS0200002	10/2/2007	29	42	30	34	NA	
X7SB021	X7SS0210002	10/3/2007	37	<29	35	36	NA	100-Yard Berm
X7SB022	X7SS0220002	10/3/2007	<27	<27	<29	NA	NA	
X7SB023	X7SS0230002	10/3/2007	30	<25	<27	30	NA	
X7SB024	X7SS0240002	10/3/2007	<28	<28	30	30	NA	
X7SB025	X7SS0250002	10/3/2007	39	<26	29	34	NA	
X7SB026	X7SS0260002	10/3/2007	27	<24	31	29	NA	
X7SB027	X7SS0270002	10/3/2007	<28	<26	<26	NA	NA	200-Yard Berm
X7SB028	X7SS0280002	10/3/2007	31	30	<27	31	NA	
X7SB029	X7SS0290002	10/3/2007	<25	<25	<25	NA	NA	
X7SB030	X7SS0300002	10/3/2007	42	55	49	49	NA	
X7SB030	X7SS0300002D	10/3/2007	29	<25	<25	29	NA	
X7SB031	X7SS0310002	10/3/2007	42	39	30	37	NA	

TABLE 2-3

SUMMARY OF SOIL SAMPLE LEAD RESULTS (XRF AND FIXED-BASE LABORATORY)
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

SAMPLE LOCATION	SAMPLE ID	SAMPLE DATE	LEAD RESULTS (ppm) XRF				LABORATORY ANALYSES (LEAD) (ppm)	SAMPLE AREA
			1	2	3	AVERAGE OF POSITIVE HITS		
X7SB032	X7SS0320002	10/3/2007	37	30	34	34	NA	300-Yard Berm
X7SB033	X7SS0330002	10/3/2007	<26	32	<27	32	NA	
X7SB034	X7SS0340002	10/3/2007	<27	<27	<26	NA	NA	
X7SB035	X7SS0350002	10/3/2007	<26	<26	<28	NA	NA	
X7SB036	X7SS0360002	10/3/2007	<25	<31	<28	NA	NA	
X7SB037	X7SS0370002	10/3/2007	37	46	47	43	NA	
X7SB038	X7SS0380002	10/3/2007	227	203	210	213	NA	Dirt Mound
X7SB039	X7SS0390002	10/3/2007	381	403	362	382	495	
X7SB040	X7SS0400002	10/3/2007	95	134	143	124	NA	
X7SB041	X7SS0410002	10/3/2007	28	30	34	31	NA	
X7SB042	X7SS0420002	10/3/2007	<26	<25	<24	NA	NA	
X7SB043	X7SS0430002	10/3/2007	42	72	72	62	NA	400-Yard Berm
X7SB044	X7SS0440002	10/3/2007	212	162	238	204	199	
X7SB045	X7SS0450002	10/3/2007	549	553	584	562	286	
X7SB046	X7SS0460002	10/3/2007	718	714	671	701	1100	
X7SB047	X7SS0470002	10/3/2007	66	79	63	69	NA	
X7SB048	X7SS0480002	10/3/2007	166	150	123	146	190	
X7SB049	X7SS0490002	10/3/2007	<27	28	<25	28	NA	500-Yard Berm
X7SB050	X7SS0500002	10/3/2007	75	54	59	63	NA	
X7SB051	X7SS0510002	10/3/2007	35	<25	<26	35	NA	
X7SB052	X7SS0520002	10/3/2007	37	40	40	39	NA	
X7SB053	X7SS0530002	10/4/2007	30	42	39	37	NA	Between 400- and 500-Yard Berms: Shooting lane
X7SB054	X7SS0540002	10/4/2007	31	<23	<25	31	NA	
X7SB055B	X7SS0550002	10/6/2007	719	798	706	741	NA	
X7SB055A	X7SS0550002D(1)	10/4/2007	1063	1043	938	1015	1160	
X7SB056	X7SS0560002	10/4/2007	<24	<25	<25	NA	NA	Between Dirt Mound and 400-Yard Berm: Shooting lane
X7SB057	X7SS0570002	10/4/2007	<24	<24	<27	NA	NA	
X7SB058B	X7SS0580002	10/6/2007	95	123	97	105	NA	Between 300-Yard Berm and Dirt Mound: Shooting lane
X7SB058A	X7SS0580002D(2)	10/4/2007	100	77	78	85	NA	
X7SB059	X7SS0590002	10/4/2007	<22	29	<23	29	NA	Between 100- and 200-Yard Berms: Shooting lane
X7SB060	X7SS0600002	10/4/2007	<23	<24	<25	NA	NA	
X7SB061	X7SS0610002	10/4/2007	<25	<24	<25	NA	NA	
X7SB062	X7SS0620002	10/4/2007	27	<24	<21	27	NA	
X7SB063	X7SS0630002	10/4/2007	<23	<24	<24	NA	NA	East Trap Range: Presumed shooters location
X7SB064	X7SS0640002	10/4/2007	<26	<21	<23	NA	NA	
X7SB065	X7SS0650002	10/4/2007	<25	33	<26	33	NA	

TABLE 2-3

SUMMARY OF SOIL SAMPLE LEAD RESULTS (XRF AND FIXED-BASE LABORATORY)
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

SAMPLE LOCATION	SAMPLE ID	SAMPLE DATE	LEAD RESULTS (ppm) XRF 1	2	3	AVERAGE OF POSITIVE HITS	LABORATORY ANALYSES (LEAD) (ppm)	SAMPLE AREA
X7SB066	X7SS0660002	10/4/2007	29	<25	28	29	10.3	East Trap Range: In line with launch area
X7SB067	X7SS0670002	10/4/2007	<26	<22	<24	NA	NA	East Trap Range: Clay pigeon launching
X7SB068	X7SS0680002	10/4/2007	<20	<24	<22	NA	NA	East Trap Range: In line with launch area
X7SB069	X7SS0690002	10/5/2007	<25	<26	<25	NA	NA	East Trap Range: ~150 feet north of shooter
X7SB070	X7SS0700002	10/9/2007	28	17	21	22	NA	
X7SB071	X7SS0710002	10/5/2007	<27	<26	<27	NA	NA	
X7SB071	X7SS0710002D	10/5/2007	<28	<23	<25	NA	NA	
X7SB072	X7SS0720002	10/4/2007	<25	<24	29	29	NA	
X7SB073	X7SS0730002	10/5/2007	41	<30	<27	41	NA	East Trap Range: ~200 feet north of shooter
X7SB074	X7SS0740002	10/5/2007	51	29	34	38	NA	
X7SB075	X7SS0750002	10/5/2007	28	30	31	30	33.1	
X7SB076	X7SS0760002	10/5/2007	<26	<24	<21	NA	NA	
X7SB077	X7SS0770002	10/5/2007	<22	<24	<24	NA	NA	East Trap Range: ~290 feet north of shooter
X7SB078	X7SS0780002	10/5/2007	<26	28	<26	28	NA	
X7SB079	X7SS0790002	10/5/2007	<26	<22	<24	NA	NA	
X7SB080	X7SS0800002	10/5/2007	<25	41	<27	41	NA	
X7SB081	X7SS0810002	10/5/2007	<26	34	<27	34	NA	
X7SB082	X7SS0820002	10/5/2007	<25	32	<29	32	NA	East Trap Range: ~300 feet north of shooter
X7SB082	X7SS0820002D	10/5/2007	<25	<26	31	31	NA	East Trap Range: ~350 feet north of shooter
X7SB083	X7SS0830002	10/5/2007	<27	<29	<25	NA	NA	
X7SB084	X7SS0840002	10/5/2007	<27	<29	<28	NA	NA	
X7SB085	X7SS0850002	10/5/2007	<29	41	<29	41	NA	
X7SB086	X7SS0860002	10/5/2007	<22	<26	<25	NA	NA	
X7SB087	X7SS0870002	10/5/2007	<23	<22	<22	NA	NA	
X7SB088	X7SS0880002	10/5/2007	<24	<22	29	29	NA	East Trap Range: ~450 feet north or shooter
X7SB089	X7SS0890002	10/5/2007	<24	29	<23	29	NA	
X7SB090	X7SS0900002	10/5/2007	45	<25	35	40	NA	
X7SB091	X7SS0910002	10/5/2007	<24	<24	<25	NA	NA	
X7SB092	X7SS0920002	10/5/2007	<23	<23	26	26	NA	
X7SB093	X7SS0930002	10/5/2007	<23	<22	<23	NA	NA	
X7SB094	X7SS0940002	10/5/2007	<24	<26	<22	NA	NA	
X7SB095	X7SS0950002	10/6/2007	<29	52	48	50	NA	West Trap Range: Presumed shooters location
X7SB096	X7SS0960002	10/6/2007	<25	<23	<25	NA	NA	
X7SB097	X7SS0970002	10/7/2007	<27	<26	<26	NA	NA	
X7SB098	X7SS0980002	10/7/2007	<24	<25	<25	NA	NA	

TABLE 2-3

SUMMARY OF SOIL SAMPLE LEAD RESULTS (XRF AND FIXED-BASE LABORATORY)
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

SAMPLE LOCATION	SAMPLE ID	SAMPLE DATE	LEAD RESULTS (ppm) XRF 1	2	3	AVERAGE OF POSITIVE HITS	LABORATORY ANALYSES (LEAD) (ppm)	SAMPLE AREA
X7SB099	X7SS0990002	10/6/2007	34	35	43	37	NA	West Trap Range: ~50 feet west of shooter
X7SB100	X7SS1000002	10/6/2007	<23	<26	<27	NA	NA	
X7SB101	X7SS1010002	10/6/2007	37	<24	<25	37	NA	
X7SB102	X7SS1020002	10/6/2007	40	<25	51	46	NA	
X7SB103	X7SS1030002	10/6/2007	27	<25	<25	27	NA	West Trap Range: ~90 feet west of shooter
X7SB104	X7SS1040002	10/6/2007	<26	29	<24	29	NA	
X7SB105	X7SS1050002	10/6/2007	31	<26	<24	31	NA	
X7SB106	X7SS1060002	10/6/2007	<25	<24	<26	NA	NA	
X7SB107	X7SS1070002	10/9/2007	28	29	27	28	NA	West Trap Range: ~125 feet west of shooter
X7SB108	X7SS1080002	10/9/2007	23	22	32	26	NA	
X7SB109	X7SS1090002	10/9/2007	27	24	26	26	NA	
X7SB110	X7SS1100002	10/6/2007	41	<24	<23	41	NA	
X7SB111	X7SS1110002	10/6/2007	<24	36	<23	36	NA	
X7SB112	X7SS1120002	10/6/2007	35	<25	<27	35	NA	West Trap Range: ~150 feet west of shooter
X7SB112	X7SS1120002D	10/6/2007	<26	<27	29	29	NA	
X7SB113	X7SS1130002	10/6/2007	31	<26	<25	31	NA	
X7SB114	X7SS1140002	10/6/2007	<27	<27	<25	NA	NA	
X7SB115	X7SS1150002	10/6/2007	31	<28	<27	31	NA	
X7SB116	X7SS1160002	10/6/2007	<25	<22	<23	NA	NA	
X7SB117	X7SS1170002	10/6/2007	34	26	32	31	NA	
X7SB118	X7SS1180002	10/6/2007	28	37	29	31	NA	
X7SB119	X7SS1190002	10/7/2007	<26	<25	37	37	NA	West Trap Range: ~175 feet west of shooter
X7SB120	X7SS1200002	10/6/2007	<24	<27	27	27	NA	
X7SB121	X7SS1210002	10/6/2007	27	30	35	31	NA	
X7SB122	X7SS1220002	10/6/2007	35	41	<27	38	NA	
X7SB123	X7SS1230002	10/6/2007	42	33	<23	38	NA	
X7SB124	X7SS1240002	10/6/2007	46	33	45	41	NA	
X7SB125	X7SS1250002	10/6/2007	<23	<25	32	32	NA	
X7SB126	X7SS1260002	10/7/2007	33	43	57	44	NA	West Trap Range: ~200 feet west of shooter along tree line
X7SB127	X7SS1270002	10/7/2007	42	31	32	35	25.3	
X7SB127	X7SS1270002D	10/7/2007	30	38	28	32	NA	
X7SB128	X7SS1280002	10/6/2007	32	35	<30	34	NA	
X7SB129	X7SS1290002	10/6/2007	40	60	38	46	NA	
X7SB130	X7SS1300002	10/6/2007	42	36	33	37	NA	

TABLE 2-3

SUMMARY OF SOIL SAMPLE LEAD RESULTS (XRF AND FIXED-BASE LABORATORY)
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

SAMPLE LOCATION	SAMPLE ID	SAMPLE DATE	LEAD RESULTS (ppm) XRF				LABORATORY ANALYSES (LEAD) (ppm)	SAMPLE AREA
			1	2	3	AVERAGE OF POSITIVE HITS		
X7SB131	X7SS1310002	10/6/2007	37	38	55	43	NA	West Trap Range: ~250 feet west of shooter inside tree line
X7SB132	X7SS1320002	10/6/2007	38	36	38	37	NA	
X7SB133	X7SS1330002	10/6/2007	<26	<25	31	31	NA	
X7SB134	X7SS1340002	10/6/2007	<25	<28	34	34	NA	
X7SB135	X7SS1350002	10/6/2007	50	38	43	44	NA	
X7SB136	X7SS1360002	10/6/2007	29	30	33	31	NA	West Trap Range: ~300 feet west of shooter inside tree line
X7SB137	X7SS1370002	10/6/2007	<26	29	29	29	NA	
X7SB138	X7SS1380002	10/6/2007	31	<26	<29	31	NA	
X7SB139	X7SS1390002	10/6/2007	50	42	42	45	NA	
X7SB140	X7SS1400002	10/6/2007	39	42	<27	41	NA	
X7SB141	X7SS1410002	10/6/2007	<27	<27	31	31	NA	
X7SB142	X7SS1420002	10/7/2007	33	25	34	31	NA	South Pistol Range: Shooting lane
X7SB143	X7SS1430002	10/7/2007	40	48	37	42	NA	
X7SB143	X7SS1430002D	10/7/2007	43	34	33	37	NA	
X7SB144	X7SS1440002	10/7/2007	<29	<29	<25	NA	NA	
X7SB144	X7SS1440002D	10/7/2007	<28	<29	33	33	NA	
X7SB145	X7SS1450002	10/7/2007	67	70	48	62	NA	
X7SB146	X7SS1460002	10/7/2007	40	37	41	39	NA	
X7SB147	X7SS1470002	10/7/2007	63	82	68	71	NA	
X7SB148	X7SS1480002	10/7/2007	137	144	163	148	71.8	
X7SB149	X7SS1490002	10/7/2007	62	49	55	55	NA	
X7SB150	X7SS1500002	10/7/2007	28	30	33	30	NA	
X7SB151	X7SS1510002	10/7/2007	24	32	30	29	NA	
X7SB152	X7SS1520002	10/7/2007	190	250	302	247	460	
X7SB153	X7SS1530002	10/7/2007	69	73	73	72	NA	
X7SB154	X7SS1540002	10/7/2007	36	18	21	25	NA	South Pistol Range: Former earth berm location
X7SB155	X7SS1550002	10/7/2007	21	28	28	26	NA	
X7SB155	X7SS1550002D	10/7/2007	33	39	27	33	NA	
X7SB156	X7SS1560002	10/7/2007	28	22	31	27	NA	
X7SB157	X7SS1570002	10/7/2007	40	39	45	41	NA	
X7SB158	X7SS1580002	10/7/2007	31	26	24	27	NA	
X7SB159	X7SS1590002	10/7/2007	22	27	<17	25	NA	South Pistol Range: South of gravel road, along tree line
X7SB160	X7SS1600002	10/7/2007	30	34	28	31	NA	
X7SB161	X7SS1610002	10/7/2007	77	61	81	73	NA	
X7SB162	X7SS1620002	10/7/2007	201	217	165	194	NA	
X7SB163	X7SS1630002	10/7/2007	62	84	69	72	NA	
X7SB164	X7SS1640002	10/7/2007	147	94	159	133	NA	
X7SB165	X7SS1650002	10/7/2007	142	105	139	129	NA	

TABLE 2-3

SUMMARY OF SOIL SAMPLE LEAD RESULTS (XRF AND FIXED-BASE LABORATORY)
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

SAMPLE LOCATION	SAMPLE ID	SAMPLE DATE	LEAD RESULTS (ppm) XRF 1	2	3	AVERAGE OF POSITIVE HITS	LABORATORY ANALYSES (LEAD) (ppm)	SAMPLE AREA
X7SB166	X7SS1660002	10/7/2007	46	52	54	51	NA	South Pistol Range: Hillside behind former earth berm. Inside tree line
X7SB167	X7SS1670002	10/7/2007	106	104	93	101	72.2	
X7SB168	X7SS1680002	10/7/2007	61	25	39	42	NA	
X7SB169	X7SS1690002	10/7/2007	<17	18	<17	18	NA	
X7SB170	X7SS1700002	10/7/2007	219	250	244	238	NA	South Pistol Range: Hillside behind former earth berm.
X7SB171	X7SS1710002	10/7/2007	19	24	30	24	NA	
X7SB172	---							
X7SB173	X7SS1730002	10/7/2007	117	135	112	121	125	Between 400- and 500-Yards Berms: Used to delineate SB55
X7SB174	X7SS1740002	10/7/2007	432	447	448	442	430	
X7SB175	X7SS1750002	10/7/2007	105	88	95	96	170	
X7SB176	X7SS1760002	10/7/2007	151	144	147	147	NA	
X7SB177	X7SS1770002	10/7/2007	124	104	116	115	115	400-Yard Berm: Used to delineate SB45 and SB46
X7SB178	X7SS1780002	10/7/2007	27	29	33	30	40.9	
X7SB179	X7SS1790002	10/7/2007	95	116	101	104	83.6	
X7SB180	X7SS1800002	10/7/2007	79	86	89	85	89	
X7SB181	X7SS1810002	10/7/2007	214	189	204	202	212	
X7SB182	X7SS1820002	10/7/2007	103	125	99	109	95.1	
X7SB183	X7SS1830002	10/7/2007	28	26	20	25	28.8	Dirt Mound: Used to delinetae SB39
X7SB184	X7SS1840002	10/7/2007	27	27	23	26	25.3	
X7SB185	X7SS1850002	10/9/2007	19	31	23	24	NA	East Trap Range: ~550 feet north of shooter
X7SB186	X7SS1860002	10/9/2007	33	35	28	32	NA	
X7SB187	X7SS1870002	10/9/2007	<16	<17	21	21	NA	
X7SB188	X7SS1880002	10/9/2007	18	30	23	24	NA	
X7SB189	X7SS1890002	10/9/2007	173	169	155	166	151	Between 400- and 500-Yards Berms: Used to delineate SB174
X7SB190	X7SS1900002	10/9/2007	354	309	341	335	NA	

MCS = Media cleanup standard
NA = Not applicable. Analyzed for PAHs and results are presented in Section 3.0.
XRF = X-Ray Fluorescence

(1) Sample was originally mislabeled on the sample bag as X7SB058. To ensure that sample was collected in correct location, a second sample was collected at X7SB055 and analyzed, with the results shown as the duplicate.
2 Due to the possible blunder with original sample at X7SB055, a second sample was collected at X7SB058 and analyzed with results shown as the duplicate.
- Shading indicates a concentration greater then the residential Media Cleanup Standard (MCS) of 400 mg/kg.
- Sample at location X7SB006 was first analyzed with XRF undried. Sample was then properly dried and reanalyzed as a duplicate.
- XRF instrument began to malfunction while analyzing X7SB152. Unable to standardize. Instrument was shut down and rental company contacted. Instrument removed from service and new instrument sent via overnight as replacement.

DRAWN BY J. ENGLISH — DATE 10/22/07 CHECKED BY R. BARRINGER — DATE 6/4/09 COST/SCHEDULE AREA SCALE AS NOTED	NAVFAC	UXO 7 SAMPLE LOCATIONS 2005 AERIAL PHOTOGRAPHY UXO 7 - RFI REPORT NSWC CRANE CRANE, INDIANA	CONTRACT NO. F272 OWNER NO. 00447 APPROVED BY — DATE DRAWING NO. FIGURE 2-1 — REV. 0

P:\GIS\CRANE_NSWC\MAPDOCS\UXO_SITES.APR UXO 7 GPS SAMPLE LOCATIONS LAYOUT C 6/4/09 KM

3.0 DATA REPORT/DATA QUALITY REVIEW

Sections 3.1 and 3.2 provide an overview of the data validation process. Section 3.3 provides an evaluation of the data quality beyond data validation. Table 3-1 contains all the qualified data. A complete printout of all field sample results is presented in Appendix D.

3.1 DATA VALIDATION PROCESS AND DATA QUALITY REVIEW

This section contains a description of the data review processes used to determine whether analytical laboratory data were of acceptable technical quality for use in decision making. The review began with data validation, which is a comparison of data quality indicators (DQIs) to prescribed acceptance criteria. The DQIs used are measures to assess the bias and precision of the analytical calibrations and sample analyses. The output of this review was a set of alphabetic flags such as ”U,” “J,” “R,” or combinations thereof that may have been assigned to individual results based on the validation effort. These flags were used to infer the general quality of the data. Also evaluated were the measures of data completeness, sensitivity, comparability and representativeness.

3.1.1 Data Validation Process

Results from the fixed-base analytical laboratory samples were validated according to several specifications. Assignment of data qualification flags conformed to U.S. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (U.S. EPA, October 1999) and Inorganic Data Review (U.S. EPA, October 2004) to the greatest extent practicable for Non-Contract Laboratory Program data. Data validation specifications require that various data qualifiers be assigned when a deficiency is detected or when a result is less than its detection limit. If no qualifier is assigned to a result that has been validated, the data user is assured that no technical deficiencies were identified during validation. The qualification flags used are defined as follows:

U – Indicates that the chemical was not detected at the numerical detection limit (sample-specific detection limit) noted. Non-detected results from the laboratory are reported in this manner. This qualifier is also added to a positive result (reported by the laboratory) if the detected concentration is determined to be attributable to contamination introduced during field sampling or laboratory analysis.

UJ – Indicates that the chemical was not detected; however, the detection limit (sample-specific detection limit) is considered to be estimated based on problems encountered during laboratory analysis. The associated numerical detection limit is regarded as inaccurate or imprecise.

J – Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually present in the sample. The laboratory reported concentration is considered to be an estimate of the true concentration.

UR – Indicates that the chemical may or may not be present. The non-detected analytical result reported by the laboratory is considered to be unreliable and unusable. This qualifier is applied in cases of gross technical deficiencies (e.g., holding times missed by a factor of two times the specified time limits, severe calibration non-compliances, and extremely low analyte recoveries).

R – Indicates that the chemical may or may not be present. The positive analytical result reported by the laboratory is considered to be unreliable and unusable. This qualifier is applied in cases of gross technical deficiencies.

The last four of the five preceding data qualifiers may be categorized as indicative of major or minor problems. Major problems are defined as issues that result in the rejection of data and qualification with UR or R data validation qualifiers. These data are considered invalid and are not used for decision-making purposes unless they are used in a qualitative way and their use is justified and documented. Minor problems are defined as issues resulting in the estimation of data and qualification with J and UJ data validation qualifiers. Estimated analytical results are considered to be suitable for decision-making purposes unless the data use requirements are very stringent and the qualifier indicates a deficiency that is incompatible with the intended data use. A U qualifier does not necessarily indicate that a data deficiency exists because all non-detect values are flagged with the U qualifier regardless of whether a quality deficiency has been detected. No data from the UXO 7 RFI at NSWC Crane were rejected and considered unusable.

3.2 DATA VALIDATION OUTPUTS

After data were validated, a list was developed of non-conformities requiring data qualifier flags that were used to alert the data user to inaccurate or imprecise data. For situations in which several QC criteria were out of specification, the data validator made professional judgements and or comments on the validity of the overall data package. The reviewer then prepared a technical memorandum presenting qualification of the data, if necessary, and the rationale for making such qualifications. The net result was a data package that had been carefully reviewed for its adherence to prescribed technical requirements. Pertinent quality estimates are summarized in a more quantitative format in the following section.

3.3 DATA QUALITY REVIEW

DQIs are parameters monitored to help establish the quality of data generated during an investigation. Some of the DQIs are generated from analysis of field samples (e.g., field duplicates), and some are generated from the analysis of laboratory samples (e.g., laboratory duplicates). Individually, field and laboratory DQIs provide measures of the performance of the respective investigative operations (field or laboratory). During data validation, individual QC results were evaluated. If individual QC results were acceptable, no validation flag was assigned to an analytical result; otherwise, a flag indicating the type of QC deficiency was assigned to the result. Samples from NSWC Crane UXO 5 were analyzed by Laucks Laboratories at the same time UXO 7 samples were analyzed. Consequently, samples from more than one UXO but of a similar matrix may have arrived at the analytical laboratory within a similar time frame. Depending on sample arrival dates, samples from different UXOs may have been combined into the same sample preparation or analysis groups for metals only. Explosives were only analyzed at UXO 5, and PAHs were only analyzed at UXO 7. Table 3-1 lists all the data that were qualified and the reasons for the qualifications. The sample results assigned the qualification code “A” were less than five times the blank action level. Sample results given the qualification code “C” were associated with a continuing calibration that had a percent recovery less than 90 percent. Sample results given the qualification code “P” were greater than the method detection limit (MDL) but less than the laboratory reporting limit (RL). This is a standard qualification for results reported near the MDL that alerts the user to the greater uncertainty of results reported near the MDL. Sample results given the qualification code “G” had greater than 50 percent relative percent difference (RPD) between field duplicate results. Sample results given the qualification code “N” were associated with an internal standard that had less than a 50 percent recovery. The sample result given the qualification code “D” was associated with a spike that had a low percent recovery (%R). The sample result with the qualification code “PN” was between the MDL and RL and had a low internal standard recovery.

3.3.1 Completeness

Completeness is a measure of the number of valid samples or measurements that are available relative to the number of samples or measurements that were intended to be generated. For this project, completeness was measured on two different bases, samples collected and laboratory measurements, as follows:

- Sample completeness was a measure of the usable samples collected as compared to those intended to be collected.

- Field measurement completeness was a measure of the usable field measurements made relative to those intended to be made.

- Laboratory measurement completeness was a measure of the amount of usable, valid, laboratory measurements per matrix obtained for each target analyte.

Usable valid samples (or results) were those judged, after data assessment, to represent the sampling populations and to have not been disqualified for use through data validation or additional data review. Completeness was determined using the following equation:

$$\%C = \frac{V}{T} \times 100$$

where	%C	=	percent completeness
	V	=	number of samples (or results) determined to be valid
	T	=	total number of planned samples (or results)

More samples than originally proposed were collected at UXO 7 to complete delineation at several locations. The percent completeness for field XRF measurements for the UXO 7 RFI was 100 percent. The percent completeness for laboratory measurements for the UXO 7 RFI was 100 percent.

3.3.2 Sensitivity

The threshold values (TVs) reported by the laboratory were less than the human health criteria for UXO 7 except for antimony and thallium. The TVs for antimony and thallium exceeded the U.S. EPA Soil Screening Level (SSL) for migration to groundwater. The impact of these exceedances is discussed in the Human Health Risk Assessment (HHRA) (Section 6.0).

To understand the impact of not having achieved screening values, it is important to understand the convention used for reporting non-detect values. Concentrations of organic analytes that were less than their MDLs were reported as the TV, which is similar to the MDL, followed by a U qualifier. The TVs were generally less than laboratory RLs but were typically greater than MDLs. The TVs represent detection limits as they apply to project-specific sample matrices, as opposed to MDLs, which are determined on ideal matrices. This convention was used in response to efforts to measure concentrations as low as the project screening values. If a measured organic analyte concentration exceeded the TV but was less than the RL, the reported concentration was the measured concentration followed by a J qualifier. The J qualifier signified that the reported concentration had a high degree of uncertainty even though there was a high level of confidence that the analyte had been detected in the sample. Concentrations less than TVs for inorganics were reported as TVs with a U qualifier. Concentrations of inorganics between TVs and RLs were reported with no qualifier. Concentrations of organics and inorganics that exceeded RLs were not qualified unless a data quality deficiency was identified.

3.3.3 Accuracy

Accuracy requirements for field measurements are typically ensured through control over sample collection and handling and through routine instrument calibration. Field accuracies were monitored through the use of blanks to detect cross-contamination and by monitoring adherence to procedures that prevent sample contamination or degradation. An equipment rinsate blank was collected during this investigation to assess cross-contamination via sample collection equipment. The blank was obtained under representative field conditions by collecting the rinse water generated by running analyte-free water through sample collection equipment after decontamination and before use. The rinsate blank was analyzed for the same chemical constituents as the associated environmental samples.

Accuracy in the laboratory was measured through the comparison of a spiked sample or laboratory control sample (LCS) result to a known or calculated value and is expressed as %R. It was also assessed by monitoring the analytical recovery of select surrogate compounds added to samples that are analyzed by organic chromatographic methods. LCSs were used to assess the accuracy of laboratory operations with minimal sample matrix effects. MS and surrogate compound analyses measure the combined accuracy effects of the sample matrix, sample preparation, and sample measurement. LCS and MS analyses were performed at a frequency of one per 20 associated samples of like matrix as required by the QAPP for SWMUs 8, 15, 18, 19, 20 and the Old Gun Tub Storage Lot, (TtNUS, 2004). Laboratory accuracy was assessed by comparing calculated %R values to accuracy control limits specified by the laboratory using SW-846 Methods.

%R is calculated using the following equation:

$$\%R = \frac{S_s - S_0}{S} \text{ X } 100\,\%$$

where	%R	=	percent recovery
	S_s	=	result of spiked sample
	S_o	=	result of non-spiked sample
	S	=	concentration of spiked amount.

All matrix spike (MS) and matrix spike duplicate (MSD) recoveries met laboratory QC limits for all samples except one. The MS/MSD for sample X7SS1210002 had a 0 %R in the MS and a 19 %R in the MSD for acenaphthene. The MS and MSD recoveries indicate a low bias for acenaphthene in this sample only. All other MS/MSD acenaphthene recoveries met QC limits.

Several PAH surrogates were outside of laboratory QC limits. However, because only one base/neutral surrogate per fraction was outside of control limits, no impact on data quality is expected and no data qualification action was taken.

All LCS/laboratory control sample duplicate (LCSD) recoveries met accuracy limits as specified by the laboratory.

3.3.4 Precision

Precision is a measure of the degree to which two or more measurements are in agreement and describes the reproducibility of measurements of the same parameter for samples analyzed under similar conditions.

Precision for chemical parameters is expressed as a RPD, which is defined as the ratio of the difference to the mean for the two values being evaluated. RPDs, typically expressed as percentages, are used to evaluate both field and laboratory duplicate precision and are calculated as follows:

$$\mathrm{RPD} = \frac{|\mathrm{V1} - \mathrm{V2}|}{(\mathrm{V1} + \mathrm{V2})/2} \times 100$$

where	RPD	=	relative percent difference
	V1, V2	=	two results obtained by analyzing duplicate samples

The precision estimates obtained from duplicate field samples encompass the combined uncertainty associated with sample collection, homogenization, splitting, handling, laboratory and field storage (as applicable), preparation for analysis, and analysis. In contrast, precision estimates obtained from analyzing duplicate laboratory samples incorporate only homogenization, subsampling, preparation for analysis, laboratory storage (if applicable), and analysis uncertainties.

Field duplicate imprecision (greater than 50 percent) for antimony was noted for sample pair X7SS0450002/X7SS0450002-D. All positive results for antimony for samples associated with the digestion batch were qualified as estimated. This field duplicate non-compliance for one metal in one field duplicate does not indicate an overall precision problem, but the associated digestion batch may be heterogeneous. This isolated event is not considered to have an impact on data quality.

All MS/MSD and LCS/LCSD RPDs met QC limits.

3.3.5 <u>Comparability</u>

Comparability is defined as the confidence with which one data set can be compared with another (e.g., among sampling points and among sampling events). Comparability was achieved by using standardized sampling and analysis methods and standardized data reporting formats. Comparability of field data was ensured by following the Quality Assurance Project Plan for SWMUs 8, 15, 18, 19, 20 and the Old Gun Tub Storage Lot, (TtNUS, 2004) and Addendum No. 2 (TtNUS, 2007). Comparability of laboratory measurements was achieved primarily through the use and documentation of standard sampling and analytical methods. Results were reported in units that ensured comparability with previous data and with current state and federal standards and guidelines. Comparability of laboratory measurements was assessed primarily through the use of QC samples and through adherence to the laboratory's QA plan.

The analyte beryllium had several continuing calibration %Rs outside of the 90 to110 percent QC limits. The out-of-control %Rs ranged from 88.1 to 89.1. There is a slight low bias for the beryllium results for samples X7SS1800002, X7SS1820002, X7SS1830002, and X7SS1840002. The impact on data quality is not expected to be significant because only four results are associated with the continuing calibration non-compliance.

3.3.6 <u>Representativeness</u>

Representativeness is an expression of the degree to which data accurately and precisely depict the actual characteristics of a population or environmental condition existing at the site. The Quality Assurance Project Plan for SWMUs 8, 15, 18, 19, 20 and the Old Gun Tub Storage Lot, (TtNUS, 2004) and Addendum No. 2 (TtNUS, 2007) and the use of standardized sampling, sample handling, sample analysis, and data reporting procedures were designed so that the final data would be accurate representations of actual site conditions. It is believed that all reported data are adequately representative of site conditions.

3.4 CORRELATION BETWEEN XRF AND FIELD METHODS

From the samples that were analyzed in the field using XRF and also at the fixed-base laboratory, a regression analysis was conducted to evaluate the correlation between the fixed base laboratory lead results and XRF lead results. To evaluate the regression analysis, the Pearson Correlation and the R-squared value were calculated. The Pearson Correlation is a measure of the strength of the linear relationship between two or more variables with a range of -1 to +1. The value of -1 represents a perfect negative correlation (as one variable decreases the other increases proportionally); whereas, a value of +1 represents a perfect positive correlation (as one variable increases the other increases proportionally). A value of 0 represents a lack of correlation. The correlation for this analysis is 0.93, indicating there is a fairly strong positive correlation between the fixed-base laboratory and field XRF lead results. The R-squared value represents the percent of variation in the fixed-base laboratory lead results that can be explained by the XRF lead results. The R-squared value for this regression analysis is 86 percent. An R-Squared value greater than 80 percent is considered to indicate a very strong relationship between the two measurement methods; the maximum possible value is 100 percent. The regression analysis is included in Appendix D. By examining the scatterplot of the regression, it can be seen that the distribution of the concentrations along the regression line is random, the laboratory concentrations are below the regression line for certain ranges of the XRF concentrations and above the regression line for different ranges of XRF concentrations. This means that the predicted laboratory concentrations are not systematically overpredicted or underpredicted based on the XRF concentrations.

TABLE 3-1

SUMMARY OF DATA QUALIFICATIONS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

SAMPLE NUMBER	PARAMETER	SAMPLE RESULT (UG/L)	UNITS	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
X7SS0020002	ANTIMONY	0.71	mg/kg	U	A	Laboratory blank contamination
X7SS0020002	SODIUM	75.7	mg/kg	U	A	Laboratory blank contamination
X7SS0030002	ANTIMONY	5.8	mg/kg	J	G	Field duplicate imprecision
X7SS0030002	SODIUM	22.7	mg/kg	U	A	Laboratory blank contamination
X7SS0040002	ANTIMONY	11.1	mg/kg	J	G	Field duplicate imprecision
X7SS0040002	SODIUM	21.1	mg/kg	U	A	Laboratory blank contamination
X7SS0120002	ANTIMONY	1.6	mg/kg	J	G	Field duplicate imprecision
X7SS0120002	SODIUM	36.8	mg/kg	U	A	Laboratory blank contamination
X7SS0120002-D	SODIUM	38.6	mg/kg	U	A	Laboratory blank contamination
X7SS0120002-D	ANTIMONY	0.86	mg/kg	U	A	Laboratory blank contamination
X7SS0190002	ANTIMONY	3.7	mg/kg	J	G	Field duplicate imprecision
X7SS0190002	SODIUM	57.8	mg/kg	U	A	Laboratory blank contamination
X7SS0390002	ANTIMONY	96.2	mg/kg	J	G	Field duplicate imprecision
X7SS0390002	SODIUM	65.3	mg/kg	U	A	Laboratory blank contamination
X7SS0440002	SODIUM	59.2	mg/kg	U	A	Laboratory blank contamination
X7SS0440002	ANTIMONY	4.5	mg/kg	J	G	Field duplicate imprecision
X7SS0450002	ANTIMONY	3.9	mg/kg	J	G	Field duplicate imprecision
X7SS0450002-D	ANTIMONY	9.4	mg/kg	J	G	Field duplicate imprecision
X7SS0450002-D	SODIUM	32.8	mg/kg	U	A	Laboratory blank contamination
X7SS0460002	ANTIMONY	24.5	mg/kg	J	G	Field duplicate imprecision
X7SS0460002	SODIUM	34.1	mg/kg	U	A	Laboratory blank contamination
X7SS0480002	ANTIMONY	5.6	mg/kg	J	G	Field duplicate imprecision
X7SS0480002	SODIUM	44.4	mg/kg	U	A	Laboratory blank contamination
X7SS0550002	SODIUM	40.5	mg/kg	U	A	Laboratory blank contamination
X7SS0550002	ANTIMONY	37.9	mg/kg	J	G	Field duplicate imprecision
X7SS0660002	ANTIMONY	0.21	mg/kg	J	G	Field duplicate imprecision
X7SS0710002	INDENO(1,2,3-CD)PYRENE	4.8	µg/kg	J	P	Uncertainty near the detection limit
X7SS0750002	ACENAPHTHENE	4.9	µg/kg	J	P	Uncertainty near the detection limit
X7SS0750002	ANTIMONY	0.93	mg/kg	J	G	Field duplicate imprecision
X7SS0750002	FLUORENE	4.6	µg/kg	J	P	Uncertainty near the detection limit

TABLE 3-1

SUMMARY OF DATA QUALIFICATIONS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

SAMPLE NUMBER	PARAMETER	SAMPLE RESULT (UG/L)	UNITS	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
X7SS0860002	BENZO(A)ANTHRACENE	0.95	µg/kg	UJ	N	Internal standard non-compliance
X7SS0860002	BENZO(A)PYRENE	1	µg/kg	UJ	N	Internal standard non-compliance
X7SS0860002	BENZO(B)FLUORANTHENE	0.95	µg/kg	UJ	N	Internal standard non-compliance
X7SS0860002	BENZO(G,H,I)PERYLENE	1	µg/kg	UJ	N	Internal standard non-compliance
X7SS0860002	BENZO(K)FLUORANTHENE	0.49	µg/kg	UJ	N	Internal standard non-compliance
X7SS0860002	CHRYSENE	0.9	µg/kg	UJ	N	Internal standard non-compliance
X7SS0860002	DIBENZO(A,H)ANTHRACENE	1.1	µg/kg	UJ	N	Internal standard non-compliance
X7SS0860002	INDENO(1,2,3-CD)PYRENE	1.3	µg/kg	UJ	N	Internal standard non-compliance
X7SS0860002	PYRENE	1.1	µg/kg	UJ	N	Internal standard non-compliance
X7SS1160002	BENZO(B)FLUORANTHENE	1400	µg/kg	J	N	Internal standard non-compliance
X7SS1160002	BENZO(G,H,I)PERYLENE	340	µg/kg	J	N	Internal standard non-compliance
X7SS1160002	BENZO(K)FLUORANTHENE	490	µg/kg	J	N	Internal standard non-compliance
X7SS1160002	DIBENZO(A,H)ANTHRACENE	69	µg/kg	J	N	Internal standard non-compliance
X7SS1160002	INDENO(1,2,3-CD)PYRENE	330	µg/kg	J	N	Internal standard non-compliance
X7SS1160002	2-METHYLNAPHTHALENE	3.9	µg/kg	J	P	Uncertainty near the detection limit
X7SS1160002	BENZO(A)PYRENE	890	µg/kg	J	N	Internal standard non-compliance
X7SS1210002	ACENAPHTHENE	550	µg/kg	J	D	Spike recovery non-compliance
X7SS1210002	BENZO(A)PYRENE	8100	µg/kg	J	N	Internal standard non-compliance
X7SS1210002	BENZO(B)FLUORANTHENE	12000	µg/kg	J	N	Internal standard non-compliance
X7SS1210002	BENZO(G,H,I)PERYLENE	2900	µg/kg	J	N	Internal standard non-compliance
X7SS1210002	BENZO(K)FLUORANTHENE	4700	µg/kg	J	N	Internal standard non-compliance
X7SS1210002	DIBENZO(A,H)ANTHRACENE	970	µg/kg	J	PN	Uncertainty near the detection limit / Internal standard non-compliance
X7SS1210002	INDENO(1,2,3-CD)PYRENE	2900	µg/kg	J	N	Internal standard non-compliance
X7SS1220002	BENZO(G,H,I)PERYLENE	5.7	µg/kg	J	P	Uncertainty near the detection limit
X7SS1220002	BENZO(K)FLUORANTHENE	6.4	µg/kg	J	P	Uncertainty near the detection limit
X7SS1220002	INDENO(1,2,3-CD)PYRENE	4.7	µg/kg	J	P	Uncertainty near the detection limit
X7SS1230002	BENZO(A)PYRENE	1600	µg/kg	J	N	Internal standard non-compliance
X7SS1230002	BENZO(B)FLUORANTHENE	2700	µg/kg	J	N	Internal standard non-compliance
X7SS1230002	BENZO(G,H,I)PERYLENE	730	µg/kg	J	N	Internal standard non-compliance

TABLE 3-1

SUMMARY OF DATA QUALIFICATIONS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

SAMPLE NUMBER	PARAMETER	SAMPLE RESULT (UG/L)	UNITS	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
X7SS1230002	BENZO(K)FLUORANTHENE	880	µg/kg	J	N	Internal standard non-compliance
X7SS1230002	DIBENZO(A,H)ANTHRACENE	150	µg/kg	J	N	Internal standard non-compliance
X7SS1230002	INDENO(1,2,3-CD)PYRENE	670	µg/kg	J	N	Internal standard non-compliance
X7SS1270002	SODIUM	62.2	mg/kg	U	A	Laboratory blank contamination
X7SS1270002	ANTIMONY	0.61	mg/kg	J	G	Field duplicate imprecision
X7SS1290002	ANTHRACENE	4.2	µg/kg	J	P	Uncertainty near the detection limit
X7SS1360002	PYRENE	3.2	µg/kg	J	P	Uncertainty near the detection limit
X7SS1480002	ANTIMONY	1.2	mg/kg	J	G	Field duplicate imprecision
X7SS1480002	SODIUM	106	mg/kg	U	A	Laboratory blank contamination
X7SS1520002	SODIUM	68.9	mg/kg	U	A	Laboratory blank contamination
X7SS1520002	ANTIMONY	6.1	mg/kg	J	G	Field duplicate imprecision
X7SS1670002	SODIUM	75.8	mg/kg	U	A	Laboratory blank contamination
X7SS1670002	ANTIMONY	0.73	mg/kg	J	G	Field duplicate imprecision
X7SS1730002	ANTIMONY	3.7	mg/kg	J	G	Field duplicate imprecision
X7SS1730002	SODIUM	83.9	mg/kg	U	A	Laboratory blank contamination
X7SS1740002	SODIUM	58.5	mg/kg	U	A	Laboratory blank contamination
X7SS1740002	ANTIMONY	12.3	mg/kg	J	G	Field duplicate imprecision
X7SS1750002	ANTIMONY	3.3	mg/kg	J	G	Field duplicate imprecision
X7SS1750002	SODIUM	31.1	mg/kg	U	A	Laboratory blank contamination
X7SS1770002	ANTIMONY	2.6	mg/kg	J	G	Field duplicate imprecision
X7SS1770002	SODIUM	50.1	mg/kg	U	A	Laboratory blank contamination
X7SS1780002	ANTIMONY	0.98	mg/kg	J	G	Field duplicate imprecision
X7SS1780002	SODIUM	43.9	mg/kg	U	A	Laboratory blank contamination
X7SS1790002	ANTIMONY	2	mg/kg	J	G	Field duplicate imprecision
X7SS1790002	SODIUM	23.8	mg/kg	U	A	Laboratory blank contamination
X7SS1800002	ANTIMONY	2.1	mg/kg	J	G	Field duplicate imprecision
X7SS1800002	BERYLLIUM	0.827	mg/kg	J	C	Calibration non-compliance
X7SS1810002	ANTIMONY	5.3	mg/kg	J	G	Field duplicate imprecision
X7SS1810002	SODIUM	19.1	mg/kg	U	A	Laboratory blank contamination
X7SS1820002	ANTIMONY	2.8	mg/kg	J	G	Field duplicate imprecision

TABLE 3-1

SUMMARY OF DATA QUALIFICATIONS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

SAMPLE NUMBER	PARAMETER	SAMPLE RESULT (UG/L)	UNITS	VALIDATION QUALIFIER	QUALIFICATION CODE	REASON FOR QUALIFICATION
X7SS1820002	BERYLLIUM	0.703	mg/kg	J	C	Calibration non-compliance
X7SS1830002	ANTIMONY	0.59	mg/kg	U	A	Laboratory blank contamination
X7SS1830002	BERYLLIUM	0.718	mg/kg	J	C	Calibration non-compliance
X7SS1840002	ANTIMONY	0.38	mg/kg	U	A	Laboratory blank contamination
X7SS1840002	BERYLLIUM	0.625	mg/kg	J	C	Calibration non-compliance
X7SS1890002	ANTIMONY	2.6	mg/kg	J	G	Field duplicate imprecision
X7SS1890002	SODIUM	64.7	mg/kg	U	A	Laboratory blank contamination
X7SS1890002	THALLIUM	0.128	mg/kg	U	A	Laboratory blank contamination

D = Indicates a duplicate sample.
mg/kg = Milligram per kilogram.
µg/kg = Microgram per kilogram.

4.0 NATURE AND EXTENT AND COPC SELECTION

This section presents a summary of the locations, spatial patterns, and concentrations of contamination detected in soil at NSWC Crane UXO 7 during the RFI field sampling event conducted in October 2007.

UXO 7 is approximately 20 acres and is comprised of the South Pistol Range, West Trap Range, and East Trap Range. Also included in this investigation was the ORR which includes the Main Target Area and the associated firing berms at distances of 100, 200, 300, 400, and 500 yards from the Main Target Area. One hundred and eighty-nine soil samples were collected to determine contaminant concentrations in soil at the sites. The areas between the ORR firing berms and a dirt mound located between the 300- and 400-yard firing berms were also sampled during this RFI.

All samples were collected at depths of 0 to 2 feet bgs and subjected to field analysis for lead utilizing a portable XRF analyzer. A subset of the soil samples in areas where the lead XRF concentration was near the decision criterion of 400 mg/kg were selected for analysis at a fixed-base laboratory for TAL metals. Additionally, samples at the former East and West Trap Ranges where maximum outfall of the clay pigeons was suspected were analyzed for PAHs. Section 2.0 provides details regarding the field investigation. Figure 2-1 shows the locations of all soil samples collected at UXO 7.

The two main concerns at UXO 7 include metals (specifically lead) from bullets at the ORR and the Old Pistol Range, and lead shot and PAHs from clay targets at the West and East Trap Ranges. The following subsections discuss results for each of the four main areas of sampling. Figure 2-1, located in Section 2.0, presents all UXO 7 soil sample locations. Table 4-1 presents the various human health screening levels used to evaluate the soil samples collected at UXO 7. Figure 4-1 presents all field XRF concentrations that exceeded the 400 mg/kg decision criteria for lead. The lead concentrations varied across the UXO 7 former small arms ranges and for the purpose of evaluating the risks for lead exposure (as described in Section 7.0). The area was subdivided into three exposure units (northern zone, central zone, and southern zone) as indicated on Figure 4-1. Figure 4-2 presents the fixed-base laboratory inorganic exceedances and Figure 4-3 presents the fixed-base laboratory semivolatile inorganic exceedances. The following subsections discuss results for each of the four main areas of sampling.

4.1 OLD RIFLE RANGE SUMMARY

The ORR consists of a Main Target Area on which targets were raised to the top of the berm. Bullets striking the targets or missing high or to the sides would pass over this target area and impact the hillside directly to the south. Bullets undershooting the targets would impact the Main Target Area berm. Personnel fired at the targets from 100-, 200-, 300-, 400-, and 500-yard berms to the north. Any lead contamination on the firing position berms would be expected from spent casings, unused ammunition, or lead residue from the firing process. Also sampled at the ORR were open areas between the firing berms, and a large dirt mound located between the 300- and 400-yard firing berms. This dirt mound was most likely placed in this area after the range had been closed because it blocks a large portion of the view from the Main Target Area to the 400- and 500-yard firing berms.

Seventy-six soil samples were collected at various locations at the ORR (see Figure 2-1), and only four had average field XRF lead concentrations that exceeded the decision criterion of 400 mg/kg (Figure 4-1).

Samples X7SS045 and 046 at the 400-yard berm had XRF lead concentrations of 562 and 701 mg/kg, respectively. The 10 other samples collected around these two locations all had XRF lead concentrations less than 400 mg/kg (see Figure 4-1). Of these 10 samples, eight were also analyzed for metals at the fixed-base laboratory, and all laboratory lead concentrations were less than 250 mg/kg. Based on these results the extent of lead contamination is well bounded horizontally in this area.

Sample X7SS055, located between the 400- and 500-yard firing positions, had a field XRF average lead reading of 1,015 mg/kg and a fixed-base laboratory lead concentration of 1,160 mg/kg. Six additional samples were collected in this area, and only one sample X7SS174, located approximately 10 feet east of X7SS055, had a lead concentration greater than 400 mg/kg (442 and 430 mg/kg, XRF and laboratory, respectively). The remaining five sample locations had XRF and laboratory lead concentrations less than 400 mg/kg, bounding the extent of lead contamination in this area horizontally (see Figure 4-1).

Sample location X7SS039, located at the large dirt mound between the 300- and 400- yard berms, had an XRF lead concentration of 382 mg/kg; however, its fixed-base laboratory lead concentration was 495 mg/kg. Additional samples collected to the north, south, east, and west all had XRF lead concentrations significantly less than 400 mg/kg. The extent of lead contamination in this area is also well bounded horizontally.

Sample location X7SS019, located along the hillside to the south of the Main Target Area, had an XRF lead concentration of 255 mg/kg; however, the fixed-base laboratory lead concentration was 537 mg/kg. Samples collected immediately to the north, east, and west all had XRF lead concentrations less than 115 mg/kg. Because the field XRF reading at X7SS019 was less than the decision criterion of 400 mg/kg, no additional sample was collected to the south, and any lead contamination in this direction is currently unbounded.

4.2 SOUTH PISTOL RANGE SUMMARY

The South Pistol Range consisted of shooting lanes in which the shooter would fire south towards targets located in front of an earthen berm. Bullets passing through, over, under, or next to the targets would have impacted the target berm or the area immediately in front of the berm. The earthen berm behind the targets was previously removed. The disposition of the material is unknown. Any lead contamination in the shooting lanes would be expected from spent casings, unused ammunition, or lead residue from the firing process.

Thirty soil samples were collected at various locations at the South Pistol Range (see Figure 2-1). Seventeen of the samples were collected in the area of the shooting lanes and in the location of the former target berm. Of these 17 samples, sample location X7SS152 had a field XRF lead concentration of 247 mg/kg; however, the fixed-base laboratory lead concentration was 460 mg/kg. This location was surrounded by additional samples with XRF lead concentrations less than 75 mg/kg. Based on the XRF readings, lead contamination is well bounded horizontally in this area. In the unlikely event that bullets would have passed over the former berm, 13 soil samples were collected from the hillside just south of the former target berm. All XRF lead concentrations from these samples were significantly less than the decision criterion of 400 mg/kg.

4.3 WEST TRAP RANGE SUMMARY

The West Trap Range consisted of a former launch area in the eastern portion of the site from which clay targets were launched to the west, and personnel standing behind or to the side of the launch area would fire shotguns at the targets.

Forty-seven soil samples were collected within the area of the former West Trap Range. Each sample was analyzed in the field for lead with the portable XRF analyzer. All XRF lead concentrations were less than 50 mg/kg. Only the sample from location X7SS127 was submitted to the fixed-base laboratory and had a lead concentration of 25.3 mg/kg. Lead contamination is therefore not a concern at the former West Trap Range (Figure 4-2).

Of the 47 samples collected at the former West Trap Range, six were submitted to the fixed-base laboratory for PAH analysis (X7SS1160002, X7SS1210002, X7SS1220002, X7SS1230002, X7SS1290002, X7SS1360002). Four of those samples (X7SS116, X7SS123, X7SS129, and X7SS121) exceeded the human health risk screening criteria for PAHs, and three of the samples (X7SS116, X7SS123, and X7SS121) exceeded the ecological risk screening level for PAHs. Based on this information, PAH contamination within the West Trap Range is horizontally unbounded.

4.4 EAST TRAP RANGE SUMMARY

The East Trap Range consisted of a former launch area in the southern portion of the site from which clay targets were launched to the north, and personnel standing behind or to the side of the launch area would fire shotguns at the targets.

Thirty-six soil samples were collected within the area of the former East Trap Range. Each sample was analyzed in the field for lead with the portable XRF analyzer. All XRF lead concentrations were less than 45 mg/kg. Samples from locations X7SS066 and X7SS075 were submitted to the fixed-base laboratory and had lead concentrations of 10.3 and 33.1 mg/kg, respectively. Lead contamination is therefore not a concern at the former East Trap Range.

Of the 36 samples collected at the former East Trap Range, five were submitted to the fixed-base laboratory for PAH analysis (X7SS0710002, X7SS0750002, X7SS0790002, X7SS0810002, X7SS0860002). Only the samples from locations X7SB071 and X7SB075 had PAHs at concentrations that exceeded human health risk screening criterion and were therefore retained in the initial screening process as COPCs. No PAHs were retained as COPCs during the initial ecological risk screening process (Figure 4-3).

4.5 SUMMARY OF NATURE AND EXTENT OF CONTAMINATION

Lead is the primary metal of concern at UXO 7. Of the 189 surface soil samples collected at UXO 7 and field screened for lead with the XRF, four sample locations (X7SB045, 046, 055, 174) had XRF lead concentrations greater than the decision criterion of 400 mg/kg. Of these four sample locations, the fixed-base laboratory metals analyses confirmed the lead exceedances at sample locations X7SB046, 055, and 174. The fixed-base laboratory lead concentration at sample location X7SB045 was 286 mg/kg, which is lower than the 400 mg/kg decision criterion. Sample locations X7SB019, 039, and 152 had field XRF lead concentrations less than 400 mg/kg; however, their respective fixed-base laboratory metals analyses had lead concentrations slightly exceeding the decision criterion of 400 mg/kg.

Eleven samples from the East and West Trap Ranges were selected for PAH analyses at a fixed-base laboratory. Eight PAHs were found to exceed ecological risk screening levels and six PAHs were found to exceed human health risk screening levels. The PAHs include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and pyrene.

TABLE 4-1

HUMAN HEALTH COPC SCREENING LEVELS
UXO 7 - RFI REPORT
NSWC CRANE

CAS Number	Chemical	U. S. EPA Region 9 PRG (Residential)[1]	IDEM Residential Soil Criteria [2]	USEPA SSLs for Migration from Soil to Groundwater[3]	IDEM Criteria Migration from Soil to Groundwater[2]	USEPA SSLs for Migration from Soil to Air Residential[4]	USEPA SSLs for Migration from Soil to Air Construction[5]
Semivolatile Organic Compounds (ug/kg)							
91-57-6	2-methylnaphthalene	5600 N[6]	630000	31000	700	NA	NA
83-32-9	Acenaphthene	370000 N	9500000	31000	130000	NA	NA
208-96-8	Acenaphthylene	370000 N[7]	1100000	31000	18000	NA	NA
120-12-7	Anthracene	2200000 N	47000000	650000	51000	NA	NA
56-55-3	Benzo(a)anthracene	150 C	5000	160	19000	NA	NA
50-32-8	Benzo(a)pyrene	15 C	500	410	8200	NA	280000
205-99-2	Benzo(b)fluoranthene	150 C	5000	490	57000	NA	NA
191-24-2	Benzo(g,h,i)perylene	230000 N[8]	NA	230000	570000	NA	NA
207-08-9	Benzo(k)fluoranthene	1500 C	50000	490	39000	NA	NA
218-01-9	Chrysene	15000 C	500000	160	25000	NA	NA
53-70-3	Dibenzo(a,h)anthracene	15 C	500	1500	18000	NA	NA
206-44-0	Fluoranthene	230000 N	6300000	310	880000	NA	NA
86-73-7	Fluorene	270000 N	6300000	41000	170000	NA	NA
193-39-5	Indeno(1,2,3-cd)pyrene	150 C	5000	1400	3100	NA	NA
85-01-8	Phenanthrene	230000 N[8]	470000	230000	13000	NA	NA
129-00-0	Pyrene	230000 N	4700000	230000	570000	NA	NA
Inorganics (mg/kg)							
7429-90-5	Aluminum	7600 N	NA	NA	NA	709000	NA
7440-36-0	Antimony	3.1 N	140	0.27	5.4	NA	NA
7440-38-2	Arsenic	0.39 C	3.9	0.29	5.8	769	58
7440-39-3	Barium	540 N	63000	82	1600	70900	170
7440-41-7	Beryllium	15 N	680	3.2	63	1380	7.1
7440-43-9	Cadmium	3.7 N	12	0.38	7.5	1840	140
7440-70-2	Calcium	NA	NA	NA	NA	NA	NA
7440-47-3	Chromium	210 C[9]	430[10]	2.1	38	276	21
7440-48-4	Cobalt	140 N[11]	NA	0.17	NA	1180	NA
7440-50-8	Copper	310 N	14000	560	920	NA	NA
7439-89-6	Iron	5500 N	NA	NA	NA	NA	NA
7439-92-1	Lead	400	400	NA	81	NA	NA
7439-95-4	Magnesium	NA	NA	NA	NA	NA	NA
7439-96-5	Manganese	180 N	NA	110	NA	70900	18
7440-02-0	Nickel	160 N	6900	14	950	NA	NA
7440-09-7	Potassium	NA	NA	NA	NA	NA	NA
7782-49-2	Selenium	510 N	1700	0.26	5.2	NA	NA
7440-22-4	Silver	510 N	1700	1.6	31	NA	NA
7440-23-5	Sodium	NA	NA	NA	NA	NA	NA
7440-28-0	Thallium	0.52 N	24	0.056	2.8	NA	NA
7440-62-2	Vanadium	7.8 N	NA	260	NA	NA	NA
7440-66-6	Zinc	2300 N	100000	680	14000	NA	NA

TABLE 4-1

HUMAN HEALTH COPC SCREENING LEVELS
UXO 7 - RFI REPORT
NSWC CRANE

CAS Number	Chemical	U. S. EPA Region 9 PRG (Residential)[1]	IDEM Residential Soil Criteria [2]	USEPA SSLs for Migration from Soil to Groundwater[3]	IDEM Criteria Migration from Soil to Groundwater[2]	USEPA SSLs for Migration from Soil to Air Residential[4]	USEPA SSLs for Migration from Soil to Air Construction[5]
Field XRF (mg/kg)							
7439-92-1	Lead	400	400	NA	81	NA	NA

Footnotes

1 - U.S. EPA Region 9 Preliminary Remediation Goal (PRG). The non-carcinogenic values (denoted with a "N" flag) are the PRG divided by 10 to correspond to a target hazard quotient of 0.1. Carcinogenic values represent an incremental cancer risk of 1.0E-06 (carcinogens denoted with a "C" flag). (U.S. EPA Region 9, 2004).

2 - Indiana Department of Environmental Management (IDEM), Risk Integrated System of Closure (RISC) residential closure levels for soil (January 2006).

3 - U.S. EPA Soil Screening Levels (SSLs). U.S. EPA Internet Site at http://risk.lsd.ornl.gov/calc_start.htm (soil to air SSLs for non-carcinogens are divided by 10). The migration to groundwater value represents a dilution attenuation factor (DAF) of 1.

4 - Indiana Department of Environmental Management (IDEM), Risk Integrated System of Closure (RISC) residential closure levels for soil (2006).

5 - U.S. EPA soil screening levels (SSLs) for the inhalation of volatiles and fugitive dusts for construction workers calculated based on methodology from U.S. EPA's Soil Screening Guidance (1996 and 2002).

6 - The value for naphthalene was used as a surrogate for 2-methylnaphthalene.

7 - The value for acenaphthene was used as a surrogate for acenaphthylene.

8 - The value for pyrene is used as a surrogate for benzo(g,h,i)perylene and phenanthrene.

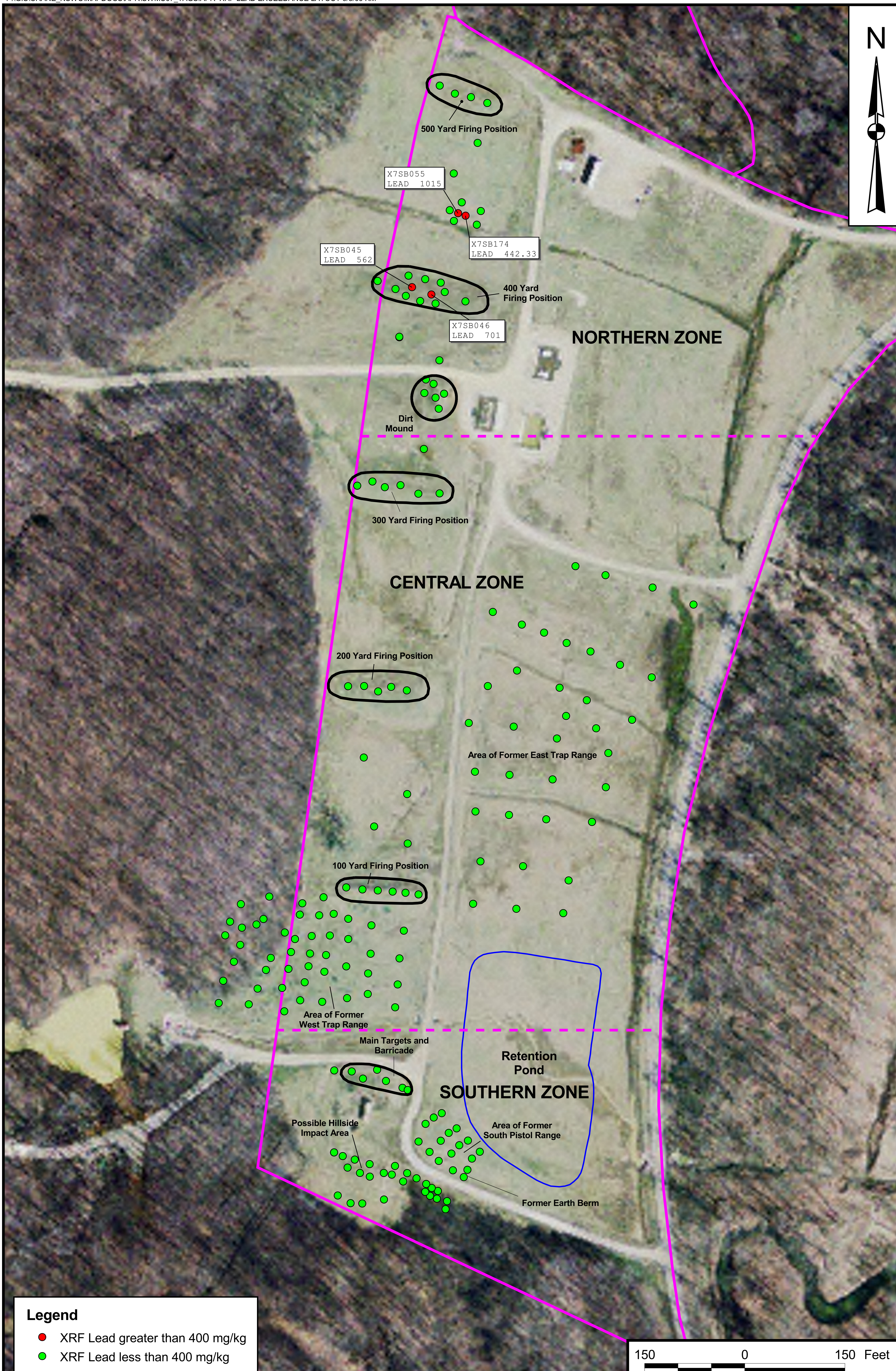
9 - The PRG for residential land use for total chromium is presented.

10 - Value is for hexavalent chromium.

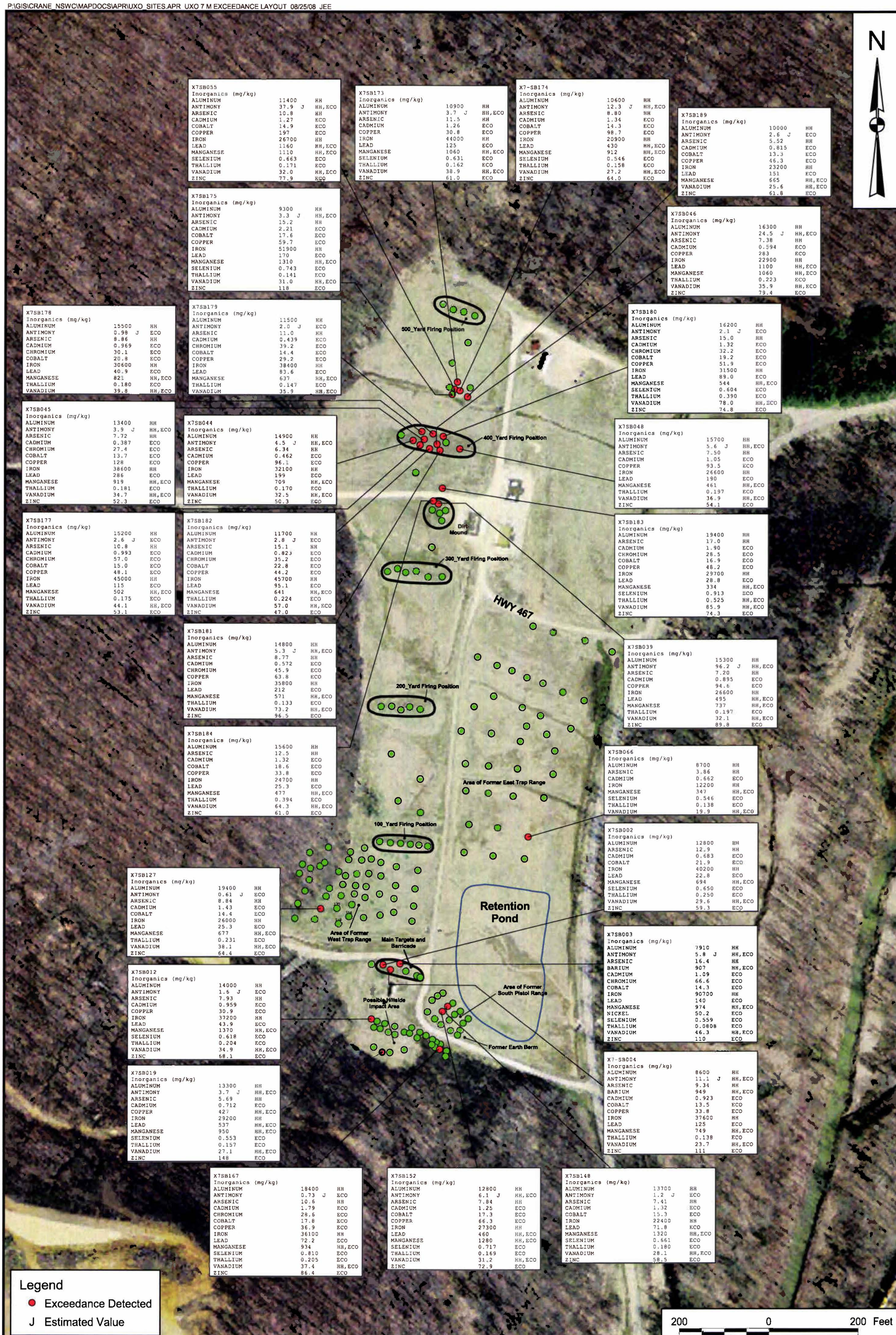
11 - One-tenth of the non-carcinogenic PRG is less than the carcinogenic PRG; therefore, the one-tenth of the noncarcinogenic PRG is presented.

Definitions:

C = Carcinogen
COPC = Chemical of potential concern
J = Estimated value
N = Non-carcinogen
NA = Not applicable/not available
PRG = Preliminary Remediation Goal



DRAWN BY J. ENGLISH — DATE 07/03/08	NAVFAC	FIELD XRF LEAD EXCEEDANCES	CONTRACT NUMBER CTO F272	OWNER NUMBER —
CHECKED BY R. BARINGER — DATE 6/3/09		UXO 7 - RFI REPORT	APPROVED BY —	DATE —
COST/SCHEDULE-AREA		NSWC CRANE	APPROVED BY —	DATE —
SCALE AS NOTED		CRANE, INDIANA	DRAWING NO. FIGURE 4-1	REV 0



DRAWN BY	DATE			CONTRACT NUMBER
J. ENGLISH	07/31/08		INORGANICS HUMAN HEALTH AND ECOLOGICAL EXCEEDANCES UXO 7 - RFI REPORT NSWC CRANE CRANE, INDIANA	CTO 0034
CHECKED BY	DATE			APPROVED BY / DATE
J. GOERDT	08/25/08	NAVFAC		APPROVED BY / DATE
COST/SCHEDULE-AREA				DRAWING NO. FIGURE 4-2 / REV 0
SCALE AS NOTED				

P:\GIS\CRANE_NSWC\MAPDOCS\APR\UXO_SITES.APR UXO 7 OS EXCEEDANCE LAYOUT 08/25/08 JEE

DRAWN BY J. ENGLISH	DATE 07/31/08	NAVFAC	SEMIVOLATILE ORGANICS	CONTRACT NUMBER CTO 0034
CHECKED BY J. GOERDT	DATE 08/25/08		HUMAN HEALTH AND ECOLOGICAL EXCEEDANCES	APPROVED BY — DATE —
COST/SCHEDULE-AREA			UXO 7 - RFI REPORT	APPROVED BY — DATE —
SCALE AS NOTED			NSWC CRANE CRANE, INDIANA	DRAWING NO FIGURE 4-3 / REV 0

5.0 CHEMICAL FATE AND TRANSPORT ANALYSIS

Knowledge of a contaminant's potential to migrate and persist in an environmental medium is critical when evaluating the potential for a chemical to elicit an adverse human health or ecological effect. This section contains information on various aspects of contaminant fate and transport and the chemical properties affecting contaminant migration at UXO 7.

The history of UXO 7 indicates that contamination at the site occurred via release of lead from the deposition of lead shot from the Old Pistol Range, ORR, and East and West Trap Ranges, and PAHs from the East and West Trap Ranges, and that the contamination was dispersed over large areas. The majority of contamination is expected to exist in the top 6 inches of soil. This section evaluates the potential for contaminants to migrate from surface soil to other environmental media at the site, namely to air, subsurface soil, and groundwater. As indicated in Section 4.0, the contaminants detected at UXO 7 were PAHs and metals. Section 5.1 contains a general discussion of the various chemical and physical properties of these contaminants, Section 5.2 reviews the various contaminant transport pathways, Section 5.3 presents a brief discussion of contaminant persistence, and Section 5.4 presents a summary of contaminant migration.

5.1 CHEMICAL AND PHYSICAL PROPERTIES IMPACTING FATE AND TRANSPORT

Table 5-1 presents the physical and chemical properties of the organic compounds detected at UXO 7. Environmental fate and transport characteristics of inorganics detected at UXO 7 are provided in Table 5-2. These properties can be used to determine the environmental mobility and fate of site contaminants, and include the following:

- Specific gravity
- Vapor pressure
- Water solubility
- Octanol/water partition coefficient (K_{ow})
- Organic carbon partition coefficient (K_{oc})
- Henry's Law constant
- Distribution coefficient (K_d)
- Plant uptake
- Biodegradation
- Mobility index (MI)

Empirically determined literature values of water solubility, K_{ow}, K_{oc}, vapor pressure, Henry's Law constant, bioconcentration factor, and specific gravity are presented in Table 5-1, when available. Calculated values, which were obtained using approximation methods, are presented when literature values are not available. A discussion of the environmental significance of each of these parameters follows.

5.1.1 Specific Gravity

Specific gravity is the ratio of the weight of a given volume of pure chemical at a specified temperature to the weight of the same volume of water at a given temperature. Its primary use is to determine whether a chemical will have a tendency to float or sink in water if it is present as a pure chemical or at very high concentrations. Chemicals with specific gravities greater than 1 will tend to sink, and chemicals with specific gravities less than 1 will tend to float. As shown in Table 5-1, the specific gravity of the PAHs detected at UXO 7 are greater than 1.

5.1.2 Vapor Pressure

Vapor pressure provides an indication of the rate at which a chemical volatilizes from both soil and water. It is of primary importance at environmental interfaces such as surface soil/air and surface water/air. Volatilization is not as important when evaluating contaminated groundwater and subsurface soil that are not exposed to the atmosphere. Volatilization is not significant for PAHs and metals; therefore, volatilization from surface soil is not an important loss mechanism for UXO 7.

5.1.3 Water Solubility

The rate at which a chemical is leached from a waste deposit by infiltrating precipitation is proportional to its water solubility. More soluble chemicals are more readily leached than less soluble chemicals. The water solubilities presented in Table 5-1 indicate that the solubilities of PAHs are low (e.g., several orders of magnitude less than compounds such as volatiles), and therefore PAHs do not tend to readily dissolve in water or leach from soil.

The solubility of inorganics is strongly influenced by their valence state(s) and forms (hydroxides, oxides, carbonates, etc.). Solubility is also dependent on pH, Eh (redox potential), temperature, and other ionic species in solution (the Debye-Huckel theory). The solubility products reported in the literature vary with the type of complex formed, but generally it can be noted that, for example, cadmium and copper complexes are more soluble than lead and nickel complexes. As shown in Table 5-2, under typical environmental conditions, lead is not soluble in water and therefore is not readily leached from soil.

5.1.4 Octanol/Water Partition Coefficient

K_{ow} is a measure of the equilibrium partitioning of chemicals between octanol and water. A linear relationship between the K_{ow} and the uptake of chemicals by fatty tissues of animal and human receptors (the bioconcentration factor) has been established. K_{ow} is also useful in characterizing the sorption of compounds by organic soils where experimental values are not available. PAHs are several orders of magnitude more likely to partition to fatty tissues than more soluble chemicals such as volatile organic compounds (VOCs). K_{ow} is also used to estimate bioconcentration factors in aquatic organisms.

5.1.5 Organic Carbon Partition Coefficient

K_{oc} indicates the tendency of a chemical to adhere to soil particles containing organic carbon. Chemicals with high K_{oc}s generally have low water solubilities and vice versa. This parameter may be used to infer the relative rates at which chemicals are transported in groundwater. Chemicals such as PAHs are relatively immobile in the soil and are preferentially bound to soil. These compounds are not subject to groundwater transport to the extent that compounds with higher water solubilities are. However, these immobile chemicals are easily transported by erosional processes (e.g., on particulate matter) when they are present in surface soils.

5.1.6 Henry's Law Constant

Both vapor pressure and water solubility are of use in determining volatilization rates from surface water bodies and from groundwater. The ratio of these two parameters (the Henry's Law constant) is used to calculate the equilibrium chemical concentrations in the vapor (air) phase versus the liquid (water) phase for the dilute solutions commonly encountered in environmental settings. In general, chemicals having a Henry's Law constant of less than 1×10^{-5} atm-m^3/mole, such as PAHs, should volatilize very little and be present only in minute amounts in the atmosphere or soil gas. For chemicals with a Henry's Law constant greater than 5×10^{-3} atm-m^3/mole, such as many of the VOCs, volatilization and diffusion in soil gas could be significant.

5.1.7 Distribution Coefficient

K_d is a measure of the equilibrium distribution of a chemical or ion in soil/water systems. The distribution of organic chemicals is a function of both the K_{oc} and the amount of organic carbon in the soil. For ions (e.g., metals), K_d is the ratio of the concentration adsorbed on soil surfaces to the concentration in water. Distribution coefficients for metals vary over several orders of magnitude because K_d is dependent on the size and charge of the ion and the soil properties governing exchange sites on soil surfaces. Coulomb's Law predicts that the ion with the smallest hydrated radius and the largest charge will be preferentially accumulated over ions with larger radii and smaller charges.

5.1.8 Plant Uptake

The degree to which plants assimilate PAHs from soils is unclear. For higher molecular weight PAHs, this mechanism is more likely, if only because the lower molecular weight PAHs tend to degrade or migrate away from plants more quickly than the higher molecular weight compounds. Plants do not appear to bioconcentrate or biomagnify PAHs significantly. Metabolism of PAHs by plants is evidently limited, with transpiration of PAHs through foliage to the atmosphere being one of the more important mechanisms for loss of PAHs from plants.

5.1.9 Biodegradation

A review of the literature indicates that degradation half-lives for PAHs are on the order of 2 to 10 years. Metals do not degrade at all. Hence, it is probable that the total mass of these constituents in surface soil at UXO 7 will remain relatively stable over time and will not decline as a result of degradation (chemical or biological).

5.1.10 Mobility Index

MI is a quantitative assessment of mobility that uses water solubility (S), vapor pressure (VP), and K_{oc} as follows:

$$MI = \log((S*VP)/K_{oc})$$

The following scale is used to evaluate MI:

Relative MI	Mobility Description
> 5	extremely mobile
0 to 5	very mobile
-5 to 0	slightly mobile
-10 to -5	immobile
< -10	very immobile

The PAHs detected at UXO 7 typically have MIs less than -5 and are not considered to be very mobile in the environment. Lighter molecular weight PAHs, such as acenaphthene, have MIs ranging from -5 to 0 and are considered slightly mobile, and the heavier molecular weight PAHs [e.g., benzo(a)pyrene] are classified as very immobile, having MIs less than -10. The MIs for the PAHs detected is surface soil at UXO 7 are presented in Table 5.1.

5.2 CONTAMINANT TRANSPORT PATHWAYS

This section presents a brief overview of contaminant fate and transport issues at UXO 7. Based on the evaluation of existing conditions at UXO 7, the following potential contaminant transport pathways have been identified:

- Transport of chemicals deposited in surface soil via infiltration, percolation, and migration to subsurface soil and the shallow groundwater aquifer. Based on the nature of the chemicals detected at UXO 7 (limited mobility in soil), risks for this exposure pathway are expected to be minimal.

- Migration of fugitive dusts and particulates from surface soil. However, because the site is grass covered, emission of dusts into air is likely to be minimal.

- Erosion and runoff of contaminated particles from soil and subsequent deposition in surface water bodies. Chemicals adhering to particulate matter in soil (or sediment) may migrate by erosional processes, such as rainwater runoff, to drainage ditches or streams adjoining UXO 7. This is a potentially important migration mechanism for environmentally immobile chemicals (e.g., PAHs and metals) that tend to bind to soil. The contaminated soil particles may be moved by runoff or the intermittent flow in drainage ditches and be deposited in nearby streams. However, as discussed in Section 6.2.1, previous investigations have indicated that the primary COCs at UXO 7 (i.e., lead and PAHs) did not appear to be migrating off site to the sediments of Turkey Creek, and it was concluded that no further investigation of surface water and sediment at UXO 7 was necessary.

5.3 CHEMICAL PERSISTENCE

The persistence of the various classes of chemicals detected at UXO 7 is discussed in this section. Several transformation mechanisms affect chemical persistence, such as hydrolysis, biodegradation, photolysis, and oxidation/reduction reactions.

5.3.1 PAHs

PAHs have very low solubilities, vapor pressures, and Henry's Law constants and high K_{oc}s and K_{ow}s. As discussed in Section 5.1.10, the lower molecular weight PAHs (e.g., acenaphthene, anthracene, fluorene, phenanthrene) are more environmentally mobile than the higher molecular weight PAHs and are more likely to leach to groundwater. The high molecular weight PAHs [e.g., benzo(a)pyrene, benz(a)anthracene, chrysene, etc.] are less mobile and tend to adhere to soil particles. Therefore, PAHs in soil are much more likely to bind to soil and be transported via mass transport mechanisms than to go into solution. PAHs are subject to degradation via aerobic bacteria but may be relatively persistent in the absence of microbial population or macronutrients such as phosphorus and nitrogen.

5.3.2 Metals

Metals are highly persistent environmental contaminants. They do not biodegrade, photolyze, hydrolyze, etc. The major fate mechanisms for metals are adsorption to the soil matrix (compared to being part of the soil structure) and bioaccumulation.

The mobility of metals is influenced primarily by their physical and chemical properties, in combination with the physical and chemical characteristics of the soil matrix. Factors that assist in predicting the mobility of inorganic species are soil/pore water pH, soil/pore water Eh, and cation exchange capacity. The mobility of metals generally increases with decreasing soil pH and cation exchange capacity (Table 5-2).

5.4 CONTAMINANT FATE AND TRANSPORT

This discussion focuses on the major types of contaminants found in surface soil at UXO 7.

5.4.1 PAHs

PAHs are generally considered to be fairly immobile chemicals in the environment. They are large molecules with high K_{oc}s and low solubilities compared to the volatile organics. These compounds, when found in soil, generally do not migrate vertically to a great extent. Instead, they are more likely to adhere to soil particles and be removed from the site via surface runoff and erosional processes.

5.4.2 Metals

The primary COC of the metals found at the small arms/skeet ranges is lead. Elemental lead from fragmented bullets and shot can be transported as a particulate by the action of surface water, groundwater, and wind. Typically, the greatest lead concentrations are measured near impact sources (impact and lateral berms and shotfall zones). The action of water and wind could distribute lead particulates and lead-enriched soil down slope or along the prevailing wind direction.

When bullet fragments and shot are exposed to the atmosphere and precipitation, elemental lead will tend to oxidize (or corrode) over time. Oxidation products consist primarily of lead hydroxide and lead carbonate. As pure solids, these oxidized compounds are nearly insoluble; however, physical abrasion of lead-rich metal fragments during erosion will release the oxidation products as dust into the environment and create particles yielding a larger surface area prone to breakdown and leaching.

The major reaction classes that govern lead transport and fate are as follows:

- Dissolution-precipitation as a function of pH
- Dissolution-precipitation as a function of redox environment
- Sorption-desorption reactions

The extent to which these reactions occur depends somewhat on site conditions such as soil composition, extent of soil saturation, and soil organic content.

Lead compounds show the greatest aqueous solubility at the acidic (pH less than 4) and alkaline (pH greater than 11) ranges. Under acidic conditions, elemental lead will dissolve, releasing a hydrated cation Pb^{2+}. Under alkaline conditions, elemental lead will dissolve, theoretically forming the dissolved hydroxide complex $Pb(OH)^{3}$ - and ion-pair $Pb(OH)^{2}$ (aqueous). Lead in water and soil with high carbonate alkalinity form the dissolved ion-pair $PbCO_3$ (aqueous). The scenario of lead transport as a dissolved hydroxide or carbonate ion occurs most frequently in contaminated calcic soils, carbonate sediments, or aqueous environments characterized by high dissolved carbon dioxide gas concentration.

When lead exists in a dissolved state, it can sorb to charged clay particle surfaces. In most natural sedimentary environments, clays carry a net negative surface charge. In a solution having neutral pH, dissolved cations are sorbed preferentially. Therefore, when dissolved lead exists as Pb^{2+} in dilute solution, transport can be attenuated by sorption to clays. These conditions occur in anoxic subsurface environments characterized by neutral to acidic pH, low dissolved solids concentrations, and low carbonate alkalinity. In contrast, when dissolved lead exists preferentially as an uncharged ion pair or negatively charged hydroxyl complex, transport can be enhanced because sorption is negligible (due to the presence of two negatively charged surfaces). These conditions can occur over a range of redox conditions but require alkaline pH, high total dissolved solids or carbonate alkalinity.

TABLE 5-1

ENVIRONMENTAL FATE AND TRANSPORT PARAMETERS FOR ORGANIC CHEMICALS
UXO 7 - RFI REPORT
NWSC CRANE
CRANE, INDIANA

Chemical	Specific Gravity (@ 20/4°C)(1)	Vapor Pressure (mm Hg @ 20-25°C)(2)	Solubility (mg/L @ 20-25°C)(3)	Octanol/Water Partition Coefficient(3)	Organic Carbon Partition Coefficient(3)	Henry's Law Constant (atm-m^3/mole)(3)	Bioconcentration Factor (mg/L/mg/kg)(4)	Mobility Index log((solubility*VP)/K_{oc})
Polynuclear Aromatic Hydrocarbons								
2-Methylnaphthalene	1.0058	5.50E-02	2.46E+01(2)	7.24E+03(2)	2.98E+03(6)	5.18E-04(2)	1.9E+02(6)	-3.34E+00
Acenaphthene	1.07	5.0E-03(1)	4.24E+00	8.32E+03	7.08E+03	1.55E-04	1.10E+03	-3.52E+00
Acenaphthylene	1.02	9.12E-04	1.61E+01(2)	1.17E+04(1)	2.00E+03	1.14E-04(1)	3.80E+02	-5.13E+00
Anthracene	1.78(2)	2.67E-06	4.34E-02	2.82E+04(2)	2.95E+04	6.51E-05	5.3E+02(6)	-1.14E+01
Benzo(a)anthracene	1.274	5.0E-09(1)	9.40E-03	5.01E+05	3.98E+05	3.35E-06	5.30E+04	-1.59E+01
Benzo(a)pyrene	1.351	5.0E-09(1)	1.62E-03	1.29E+06	1.02E+06	1.13E-06	1.40E+05	-1.71E+01
Benzo(b)fluoranthene	NA	5.0E-07(1)	1.50E-03	1.58E+06	1.23E+06	1.11E-04	1.40E+05	-1.52E+01
Benzo(g,h,i)perylene	NA	1.0E-10(1)	2.6E-04(2)	1.7E+07(1)	1.60E+06	2.66E-07(2)	3.50E+05	-1.98E+01
Benzo(k)fluoranthene	NA	9.6E-11(1)	8.00E-04	1.58E+06	1.23E+06	8.29E-07	1.40E+05	-1.92E+01
Chrysene	1.274(5)	6.3E-09(6)	1.60E-03	5.01E+05	3.98E+05	9.46E-05	5.30E+04	-1.66E+01
Dibenzo(a,h)anthracene	1.282	1.4E-11(6)	2.49E-03	4.90E+06	3.80E+06	1.47E-08	6.90E+05	-2.00E+01
Fluoranthene	1.252	9.2E-06(6)	2.06E-01	1.32E+05	1.07E+05	1.61E-05	1.20E+04	-1.08E+01
Fluorene	1.202	3.20E-04	1.98E+00	1.62E+04	1.38E+04	6.36E-05	3.80E+03	-7.34E+00
Indeno(1,2,3-cd)pyrene	NA	1.25E-10(6)	2.20E-05	4.47E+06	3.47E+06	1.60E-06	3.50E+05	-2.11E+01
Phenanthrene	0.98(5)	1.12E-04(6)	6.0E-01(2)	3.72E+04(2)	2.08E+04(6)	4.22E-05(6)	5.4E+02(6)	-8.49E+00
Pyrene	1.271(5)	8.92E-05	1.35E-01	1.29E+05	1.05E+05	1.10E-05	1.20E+04	-9.94E+00

NA - Not available.
1 - U.S. EPA, Handbook of RCRA Groundwater Monitoring Constituents: Chemical and Physical Properties (September 1992).
2 - TOXNET (Hazardous Substance Data Bank) (http://toxnet.nlm.nih.gov, July 2006).
3 - U.S. EPA, Soil Screening Guidance (July 1996 and December 2002).
4 - U.S. EPA, Aquatic Fate Process Data for Organic Priority Pollutants (December 1982).
5 - U.S. EPA, Superfund Chemical Data Matrix (http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm, July 2006).
6 - Risk Assessment information System (http://risk.lsd.ornl.gov, July 2006).

TABLE 5-2

RELATIVE MOBILITIES OF INORGANICS AS A FUNCTION OF ENVIRONMENTAL CONDITIONS (Eh, pH)
UXO 7 - RFI REPORT
NWSC CRANE
CRANE, INDIANA

Relative Mobility	Environmental Conditions			
	Oxidizing	Acidic	Neutral/Alkaline	Reducing
Very High			Se	
High	Sb, Se, Zn	Sb, Se, Zn, Cu, Ni, Hg,Ag		
Medium	Cu, Ni, Hg, Ag, As, Cd	As, Cd	As, Cd	
Low	Pb, Ba, Sb, Se	Pb, Ba, Be	Pb, Ba, Be	
Very Low	Fe, Cr	Cr	Cr, Zn, Cu, Ni, Hg, Ag	Cr, Sb, Se, Zn, Cu, Ni, Hg, Pb, Ba, Be, Ag

As = Arsenic
Ag = Silver
Ba = Barium
Be = Beryllium
Cd = Cadmium
Cr = Chromium
Cu = Copper
Fe = Iron
Hg = Mercury
Ni = Nickel
Pb = Lead
Sb = Antimony
Se = Selenium
Zn = Zinc

Source: Swartzbaugh, J., et al. "Remediating Sites Contaminated with Heavy Metals, Parts I, II, and III," Hazardous Materials Control, November/December 1992.

6.0 HUMAN HEALTH RISK ASSESSMENT

This section presents the HHRA for UXO 7 at NSWC Crane. The objective of the HHRA was to determine whether detected concentrations of chemicals within the study area pose a significant threat to potential human receptors under current and/or future land use. The potential risks to human receptors were based on the assumption that no actions were taken to control contaminant releases.

6.1 INTRODUCTION

The following current U.S. EPA, Indiana Department of Environmental Management (IDEM) and United States Navy risk assessment guidance documents were used to develop the framework for the baseline HHRA:

- Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part A) (U.S. EPA, 1989).
- Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors (U.S. EPA, 1991).
- Distribution of Preliminary Review Draft: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure (U.S. EPA, 1993a).
- Soil Screening Guidance: Technical Background Document (U.S. EPA, 1996).
- Exposure Factors Handbook. Office of Health and Environmental Assessment (U.S. EPA, 1997a).
- Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments) (U.S. EPA, 2001).
- Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final Guidance (U.S. EPA, 2004a).
- Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. (U.S. EPA 2002a).

- Navy Final Policy on the Use of Background Chemical Levels (Navy, 2004).

- Conducting Human Health Risk Assessments under the Environmental Restoration Program (Navy, 2001).

- Risk Integrated System of Closure. User's Guide and Technical Resource Guidance Document (IDEM, 2004).

This HHRA was prepared using essentially the same methodology used to prepare the HHRAs for SWMU 12 (TtNUS, 2006), SWMU 13 (TtNUS, 2005a), and SWMU 16 (TtNUS, 2005b).

An HHRA consists of five components: data evaluation, exposure assessment, toxicity assessment, risk characterization, and uncertainty analysis. Sections 6.2 through 6.6 contain detailed discussions of the five components of the HHRA.

Three major aspects of chemical contamination and environmental fate and transport must be considered to evaluate potential risks: (1) contaminants with toxic characteristics must be found in environmental media and must be released by either natural processes or by human action; (2) potential exposure points must exist; and (3) human receptors must be present at the point of exposure. Risk is a function of both toxicity and exposure. If any one of these factors is absent for a site, the exposure route is regarded as incomplete, and no potential risks are considered to exist for human receptors.

6.2 DATA EVALUATION

Data evaluation, the first component of a baseline HHRA, is a medium-specific task involving the compilation and evaluation of analytical data. The main objective of the data evaluation is to develop a medium-specific list of chemicals of potential concern (COPCs) that will be used to quantitatively determine potential human health risks for site media.

6.2.1 <u>Data Usability</u>

Data from surface soil samples (0 to 2 feet bgs) collected during the October 2007 field investigation were used to assess risks to potential human receptors. All samples were analyzed in the field for lead utilizing a portable XRF analyzer. A subset of the samples was selected for fixed-base laboratory analysis for PAHs and metals. The data were validated according to U.S. EPA National Validation Functional Guidelines for Organic Data Review (1999), the Laboratory and Data Validation Functional Guidelines for

Evaluation of Inorganic Analysis (1994), and TtNUS SOPs. Only fixed-base analytical results from the field investigations were used in the quantitative risk evaluation. All detected concentrations with "J" qualifiers are considered positive detections and were used in the risk evaluation. XRF data and field measurements were not used in the quantitative risk assessment. The uncertainty associated with omission of the XRF data from the quantitative risk assessment is discussed in Section 6.6.1.

A data quality report is included in Section 3.0 that provides information on precision, accuracy, representativeness, completeness, and comparability of the analytical data.

Surface water, sediment, and groundwater were not evaluated in the HHRA. Previous investigations (TtNUS, 1999 and 2007) indicated that the primary chemicals of concern at UXO 7 (i.e., lead and PAHs) did not appear to be migrating off site to the sediments of Turkey Creek. It was concluded that no further investigation of surface water and sediment at UXO 7 was necessary. Therefore, risks to potential human receptors from concentrations of chemicals in surface water and sediment were not evaluated in this HHRA because additional surface water and sediment samples were not collected as part of this RFI. Groundwater is not considered a medium of concern at UXO 7 because contamination occurred in surface soil (via deposition), and groundwater samples were not collected as part of the RFI.

6.2.2 Selection of Chemicals of Potential Concern

COPCs are the target analytes detected in environmental media and that are selected for further evaluation in a risk assessment. COPCs are selected on the basis of comparison to available screening concentrations; generally, a chemical is designated as a COPC if it is detected at least once at concentrations greater than the limit of detection for that chemical and its maximum concentration exceeds a screening concentration. Chemicals eliminated from further evaluation during this screening are assumed to present minimal risks to potential human receptors. COPC selection for UXO 7 is presented in Tables 6-1 and 6-2.

6.2.2.1 Derivation of Screening Criteria

Screening levels used to identify COPCs for UXO 7 were based on U.S. EPA Region 9 Preliminary Remediation Goals (PRGs) (2004) and IDEM Risk Integrated System of Closure (RISC) default closure levels (2006), as well as other U.S. EPA criteria [e.g., U.S. EPA “migration to groundwater” (i.e., leaching)] SSLs. The risk-based U.S. EPA Region 9 screening concentrations correspond to a Hazard Quotient (HQ) of 0.1 (for noncarcinogens) or an Incremental Lifetime Cancer Risk (ILCR) of 1×10^{-6} (for carcinogens). The U.S. EPA Region 9 PRGs for non-carcinogens are based on a Hazardous

Index (HI) of 1. The Region 9 PRG values for non-carcinogens were multiplied by 0.1 to account for potential cumulative effects of several chemicals affecting the same target area or producing the same adverse non-carcinogenic health effect. Screening concentrations based on the following criteria were used to select COPCs for surface soil at UXO 7:

- U.S. EPA Region 9 PRGs for residential soil (2004).

- IDEM residential default closure levels for direct contact (2006). The IDEM risk-based default closure levels correspond to a systemic HQ of 1 for non-carcinogens or an ILCR of 1 x 10^{-5} for carcinogens.

- U.S.EPA generic residential SSLs for inhalation of volatiles and fugitive dusts calculated online using methodology from the U.S. EPA's Soil Screening Guidance (1996 and 2002).

- U.S.EPA SSLs for inhalation of volatiles and fugitive dusts for construction workers calculated based on methodology from the U.S. EPA's Soil Screening Guidance (1996 and 2002).

- U.S.EPA generic SSLs for migration from soil to groundwater calculated online based on methodology from the U.S. EPA's Soil Screening Guidance (1996 and 2002).

- IDEM residential default closure levels for migration from soil to groundwater (2006)

The comparison of site soil data to U.S. EPA generic SSLs for transfers from soil to air was used to identify whether a quantitative analysis of the inhalation of particulates or vapors from the soil exposure pathway was warranted. If the maximum soil concentration of a chemical exceeded the SSL, a quantitative evaluation of potential risks from inhalation was performed, as described in Section 6.3.4.3. Otherwise, the risks associated with the inhalation pathway are considered insignificant, and the exposure pathway was eliminated from further evaluation.

U.S. EPA SSLs and IDEM default closure levels for transfers from soil to groundwater were not used to select COPCs for quantitative risk evaluation but were presented to allow a qualitative evaluation of the potential for chemical migration from soil to groundwater. Chemicals with concentrations exceeding the SSLs and IDEM default closure levels may potentially migrate from the soil to groundwater in sufficient quantities to pose concerns about groundwater quality.

Lead as a COPC

Limited criteria are available to evaluate the potential risks associated with lead. There are no risk-based concentrations (RBCs) for this chemical because U.S. EPA has not derived toxicity values [i.e., cancer slope factors (CSFs) and reference doses (RfDs)] for lead. However, recommended screening levels are available for lead in soil that are used to indicate the need for response activities.

Guidance from both the Office of Prevention, Pesticides, and Toxic Substances (OPPTS) and the Office of Solid Waste and Emergency Response (OSWER) recommend 400 mg/kg as the lowest screening level for lead-contaminated soil in a residential setting where children are frequently present (U.S. EPA, 1994a and 1994b). The IDEM soil direct contact for residential exposure to soil is also 400 mg/kg. OPPTS identifies 2,000 to 5,000 mg/kg as an appropriate range for areas where contact with soil by children in a residential setting is less frequent. Guidance from the U.S EPA Technical Review Workgroup (TRW) for Lead indicates that “a reasonable screening level for lead in soils at commercial/industrial (i.e., non-residential) sites is 800 mg/kg” for a typical non-contact intensive worker (2008). The residential screening values of 400 mg/kg was used as the screening level for soil for UXO 7.

Essential Nutrients and Chemicals without Toxicity Criteria

The essential nutrients calcium, magnesium, potassium, and sodium were not identified as COPCs because these inorganic chemicals are naturally abundant in environmental matrices and are only toxic at high doses. In addition, because of the lack of toxicity criteria, risk-based COPC screening levels are not available for some chemicals [e.g., acenaphthylene, 2-methylnaphthalene, benzo(g,h,i)perylene, and phenanthrene]. In the COPC screening for UXO 7, acenaphthene was used as a surrogate for acenaphthylene, naphthalene was used as a surrogate for 2-methylnaphthalene, and pyrene was selected as a surrogate for benzo(g,h,i)perylene and phenanthrene.

Determination of Site-Related Chemicals

TtNUS issued the Final Basewide Background Soil Investigation Report for the Naval Surface Warfare Center Crane in January 2001 and established a background database for soil for the entire NSWC Crane facility (TtNUS, January 2001). The results of that report were intended to support applicable RCRA Corrective Action requirements and other related environmental investigations conducted at NSWC Crane. One step typically performed when evaluating the risk of inorganic chemical is a comparison of the chemical concentrations measured in the soil under investigation to their background concentrations. This comparison is made because many inorganic chemicals occur naturally in the environment, so typical background concentrations would be those concentrations of inorganics detected in soil that has not been impacted by facility operations. Using this approach, the background inorganic soil chemistry established for specific soil types or grouped soils in the database can be used to differentiate site-related contamination from known or suspected SWMUs, Areas of Concern, or other impacted sites at NSWC Crane from the naturally occurring and anthropogenic concentrations in the soil prior to U.S. Navy site operations.

The surficial geology map presented in the background soil report (TtNUS, 2001) indicates that the UXO 7 area contains residual soil derived from Mississippian bedrock/colluvium, primarily the sandstone member of the Big Clifty Formation (M5). The surficial geology map also indicates that the easternmost margins of UXO 7 area contain river-deposited alluvium-derived soil along the floodplains of Turkey Creek.

The soil types mapped in the UXO 7 area have been classified as Wellston silt loam (WeC2), which is derived from residual soils and colluvium on side slopes and uplands. There are some minor areas on the margins of the site that are classified as alluvium-derived soils and these are located near creeks in flood plains zones. In the area near between the 500-yard and 400-yard firing positions, the Burnside loam (Bu) has been mapped in the northern portion of the site along tributary stream that discharges to Turkey Creek to the east. Along the eastern portion of the UXO 7 area the Haymond silt loam (Hd) has been mapped on the floodplains near Turkey Creek. Collectively, these soil types are consistent with Soil Group 3 (Alluvial, Mississippian, and Pennsylvanian Surface Soil) as described and presented in the background soil report (TtNUS, January 2001).

The evaluation of chemical concentrations detected in UXO 7 soil in relation to background levels follows guidance presented in the U.S. EPA's Role of Background in the CERCLA Cleanup Program (2002). This guidance document recommends that all chemicals that exceed risk-based screening concentrations be evaluated in the quantitative risk assessment. Therefore, if the maximum concentration of any chemical exceeded screening levels (i.e., if it was selected as a COPC), risks were calculated for that chemical and are presented in Section 6.5. Potential risks attributed to background levels are discussed in Sections 6.5 and 6.6.

6.2.2.2 Decision Rules for Establishing COPCs

The following decision rules were used to select initial lists of COPCs for UXO 7:

- A chemical detected in soil was selected as a COPC for soil if any detected chemical concentration exceeded the screening level for soil.

- Chemicals that exceeded toxicity screening concentrations but were within background levels were selected as COPCs and carried through the quantitative risk assessment. The potential risks associated with chemicals present at naturally occurring levels are discussed in Sections 6.5 and 6.6.

6.2.3 COPCs Selected for HHRA

COPCs for UXO 7 were selected for surface soil using the COPC screening levels described in Section 6.2.2.1. A discussion of the chemicals identified as COPCs and the rationale for COPC selection are provided in the following section. A discussion of nature and extent of contamination associated with the chemicals detected in surface soil is presented in Section 4.0. COPC selection results are presented in Tables 6-1 and 6-2. Chemicals retained as COPCs for UXO 7 are presented in Table 6-3. The Risk Assessment Guidance for Superfund (RAGS) Part D tables for COPC selection are included in Appendix E.

Sixteen PAHs and 22 metals were detected in surface soil samples collected at UXO 7. A comparison of maximum detected surface soil concentrations to screening levels based on the U.S. EPA Region 9 PRGs for residential exposure and IDEM residential default closure levels for direct contact is presented in Table 6-1. The following chemicals were detected in surface soil at maximum concentrations exceeding the direct contact risk-based COPC screening levels and were retained as COPCs for quantitative risk evaluation:

- PAHs - benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene

- Inorganics - aluminum, antimony, arsenic, barium, copper, iron, lead, manganese, thallium, and vanadium

The maximum detected concentrations of aluminum, barium, copper, manganese, and thallium exceeded the screening levels (set at an HI of 0.1). However, they do not exceed U.S. EPA Region 9 PRGs and IDEM default closure levels for direct contact with soil. The maximum concentrations of benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, and antimony exceeded the screening levels based on U.S. EPA Region 9 PRGs, however the peak concentrations for these analytes were also below the IDEM residential direct contact soil criteria levels. As shown in Table 6-1, the concentrations of barium, manganese, and thallium were determined to be within facility background levels and are not considered to be related to past activities at the site.

A comparison of maximum detected surface soil concentrations to U.S. EPA SSLs for chemical migration from soil to air is presented in Table 6-2. As shown in the table, maximum concentrations of all chemicals were less than U.S. EPA inhalation SSLs for residential exposures. However, maximum concentrations of barium, chromium, and manganese exceeded inhalation SSLs for construction workers. Therefore, exposures through inhalation of fugitive dust emissions from soil were quantitatively evaluated for exposure of construction workers for these metals. The maximum concentration of barium exceeded the screening level (set at an HI of 0.1) but did not exceed the SSL based on an HI of 1. As shown in Table 6-2, barium and manganese concentrations were determined to be within background levels. The uncertainty associated with the inclusion of barium and manganese in the quantitative risk assessment is discussed in Section 6.6.1.

Comparison of maximum detected surface soil concentrations to U.S. EPA SSLs for chemical migration from soil to groundwater and/or IDEM default closure levels for migration to groundwater are presented in Table 6-2. The following constituents were detected at maximum concentrations in surface soil that exceeded the COPC screening levels for migration from soil to groundwater and were retained as COPCs for surface soil:

- PAHs - benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, and indeno(1,2,3-cd)pyrene

- Inorganics - antimony, arsenic, barium, cadmium, chromium, cobalt, lead, manganese, nickel, selenium, and thallium

The concentrations of the above-listed PAHs exceeded U.S. EPA screening levels (based on a conservative Dilution and Attenuation Factor [DAF] of 1) for migration from soil to groundwater but were less than IDEM default closure levels and U.S. EPA screening levels based on a DAF of 20 (which is recommended in the U.S. EPA Soil Screening Guidance). As shown in Table 6-2, concentrations of barium, cadmium, cobalt, manganese, and thallium were determined to be within facility background levels.

6.3 EXPOSURE ASSESSMENT

This portion of the risk assessment defines and evaluates, quantitatively or qualitatively, the type and magnitude of human exposure to the chemicals present at or migrating from a site. The exposure assessment is designed to depict the physical setting of the site, to identify potentially exposed populations and applicable exposure pathways, to calculate concentrations of COPCs to which receptors might be exposed, and to estimate chemical intakes under the identified exposure scenarios.

Actual or potential exposures at UXO 7 were determined based on the most likely pathways of contaminant release and transport, as well as human activity patterns. A complete exposure pathway has three components: a source of chemicals that can be released to the environment, a route of contaminant transport through an environmental medium, and an exposure or contact point for a human receptor.

6.3.1 Conceptual Site Model

The development of a conceptual site model (CSM) is an essential component of the exposure assessment. The CSM integrates information regarding the physical characteristics of the site, exposed populations, sources of contamination, and contaminant mobility (fate and transport) to identify potential exposure routes and receptors to be evaluated in the risk assessment. The degree of risk incurred by a potential receptor varies according to the means of exposure, the duration of exposure, and the specific chemical to which the receptor is exposed. An exposure, however long in duration, does not necessarily result in an “unacceptable” health or environmental risk, although risks generally increase with increased frequency and/or duration of exposure. A well-developed CSM will allow for a better understanding of the risks at a site and will aid risk managers in the identification of the potential need for remediation. The site-specific CSM for UXO 7 is presented in this section and illustrated in Figure 6-1. The CSM depicts the relationships among the following elements:

- Site sources of contamination
- Contaminant release mechanisms and transport/migration pathways
- Exposure routes
- Potential receptors

The elements of the CSM (i.e. sources of contamination, contaminant release mechanisms, transport and migration pathways, exposure routes, and potential receptors) and how they pertain to UXO 7 are discussed below. A summary of the exposure routes addressed quantitatively for each human receptor is provided in Table 6-4.

6.3.1.1 Site Sources of Environmental Contamination

UXO 7 is located within the boundaries of the ORR, which occupies approximately 20 acres. The ORR is part of a larger unit designated as SWMU 7. UXO 7 is located immediately west of NSWC Crane Highway 8 in the flat-lying floodplain of Turkey Creek. The site consists of a flat, grass-covered area bisected from north to south by an unnamed but maintained gravel road. This road provides access to various groundwater monitoring wells located within SWMU 7 and to a powder burning area that is a RCRA-permitted OB facility. Currently, only the area of the ORR consisting of the OB facility is active. The other areas used for rifle and pistol target practice are inactive. During previous RFI activities conducted at SWMU 7, three new ranges were identified, West Trap Range, East Trap Range, and South Pistol Range. A fourth area also investigated during this field event includes the rifle range along with its main target area. Munitions handled at all of these locations consisted of small arms. During a preliminary site visit, no MEC were observed, and based on the nature of the site operation, MEC are not suspected to be present. MCs that might be present would consist of lead shot fired from the weapons. Contamination would be located primarily in surface soil including the drainage areas to the east of the site because lead mobility in soil is low.

UXO 7 includes three distinct zones currently under investigation: the Northern Zone (500- and 400-yard firing positions and dirt mound), the Central Zone (300-, 200-, and 100-yard firing positions and former East and West Trap Ranges), and the Southern Zone (main targets and barricade, hillside impact area, and former South pistol range). All of these areas were used for small arms firing activities including rifle, pistol and trap (Figure 4-1).

The configuration and past use of the site are such that MC releases to surface soil from the pistol range and trap shooting areas are expected to be of small quantities. Release of metals (lead) would occur through the deposition of lead shot dispersed over large areas. Thus, the majority of contamination is expected to exist in the top layer (upper 6 inches) of the surrounding soil. The contaminants may have migrated through surface soil to deeper soil and perhaps as deep as the groundwater table. However, the majority of contamination is expected to reside near or in surface soil because of the deposition mechanism and the very limited mobility of lead in soil. Surface soil poses the most significant exposure route for humans.

Based on historical site data and sampling, the following parameters are among the site-related chemical contaminants known to be present or potentially present in surface soil at UXO 7:

- Semivolatile organic compounds (namely PAHs)
- Inorganics

6.3.1.2 Potential Contaminant Release Mechanisms and Transport/Migration Pathways

As described in Section 6.3.1.1, the configuration and past use of the site are such that the majority of contamination is expected to exist in the top layer (upper 6 inches) of the surrounding soil. Even though contaminants may have migrated through surface soil to deeper soil and perhaps as deep as the groundwater table, the majority of contamination is expected to reside near or in surface soil because of the deposition mechanism and the very limited mobility of contaminants detected in soil at UXO 7 (i.e. PAHs and metals, especially lead). Based on information regarding past practices and chemical releases at the site, plausible contaminant release and migration mechanisms include the following:

- Transport of chemicals deposited in surface soil via infiltration, percolation, and migration to subsurface soil and the shallow groundwater aquifer. Given the nature of the chemicals detected at UXO 7 (limited mobility in soil), risks for this exposure pathway are expected to be minimal.

- Migration of fugitive dusts and particulates from surface soil. However, because the site is grass covered, emission of dusts into air is likely to be minimal.

6.3.1.3 Potential Current and Future Receptors of Concern and Exposure Pathways

NSWC Crane is an active Naval base and is expected to remain active for the foreseeable future. For purposes of completeness, the baseline risk assessment considers receptor exposure under residential, industrial, and recreational land use scenarios. Based on current and potential future land use, the following potential receptors may be exposed to contaminated environmental media within UXO 7:

- **Maintenance Workers** – A plausible receptor under current and future land use. This includes adult military or civilian personnel assigned duties on an infrequent basis within the study area (e.g., groundskeeping activities, storm sewer and drainage maintenance). This receptor could be exposed to surface soil via incidental ingestion, dermal contact, and inhalation.

- **Occupational Worker** – A plausible receptor under current and future land use. This includes adult military or civilian personnel assigned to routine daily work tasks. This receptor could be exposed to surface soil via incidental ingestion, dermal contact, and inhalation. This receptor is expected to be exposed on a more frequent basis than the maintenance or construction worker.

- **Trespassers** – A plausible receptor under current or future land use. Although access to the base is controlled, once inside the base, access to the study area is not limited by any physical constraints. In addition, hunting activities are permitted at the base. Because the study area is relatively remote and surrounded by forested areas, hunters (particularly adolescents) may trespass within the study areas. This receptor may be exposed to potentially contaminated surface soil via incidental ingestion, dermal contact, and inhalation.

- **Construction Workers -** A plausible receptor under future land use. Construction/excavation workers are evaluated in the risk assessment to account for the possibility that excavation and construction could occur in the study area in the future. This receptor could be exposed to soil by incidental ingestion, dermal contact, and air (inhalation).

- **Recreational Users (Child and Adult)** – A plausible receptor under future land use. If NSWC Crane were to close, the most likely scenario is that the property would be converted to a park. A recreational user may be exposed to potentially contaminated surface soil via incidental ingestion, dermal contact, and inhalation.

- **On-Base Residents (Child and Adult)** – An unlikely receptor under future land use. Although this scenario is highly unlikely, a future residential scenario is typically evaluated in a risk assessment for decision-making purposes. For example, the need for deed restrictions at a site may be eliminated prior to site closure if minimal risks are estimated for residential receptors. It is assumed that a hypothetical resident may be exposed to surface soil via incidental ingestion, dermal contract, and inhalation.

Details regarding the assumed receptor characteristics (e.g., intake rate, frequency, and duration of exposure) are defined in Section 6.3.4.

6.3.2 Central Tendency Exposure Versus Reasonable Maximum Exposure

Traditionally, exposures evaluated in the HHRA were based on the concept of a reasonable maximum exposure (RME) only, which is defined as "the maximum exposure that is reasonably expected to occur at a site" (U.S. EPA, 1989). However, subsequent risk assessment guidance (U.S. EPA, 1992) indicates the need to address an average case or central tendency exposure (CTE).

To provide a full characterization of potential exposure, both RME and CTE scenarios were evaluated in the HHRA for UXO 7. The available guidance (U.S. EPA, 1993) concerning the evaluation of CTE is limited and at times vague. Therefore, professional judgment was exercised when defining CTE conditions for a particular receptor at a site.

6.3.3 Exposure Point Concentrations

The exposure point concentration (EPC), which is calculated for COPCs only, is an estimate of the chemical concentration within an exposure unit (EU) likely to be contacted over time by a receptor and is used to estimate exposure intakes. An EU is defined as the area typically encountered/traversed by a receptor under a particular land use scenario. For example, a residential lot size of ¼ acre to 2 acres is often used for the evaluation of a hypothetical future resident. However, the size of an EU is typically based on the distribution of chemical concentrations in a medium as well as on presumed receptor activity patterns.

The EU for surface soil at UXO 7 consists of the portions of the site where surface soil sampling was conducted, namely the West Trap Range, East Trap Range, South Pistol Range, ORR shooting lanes and main target area, and the hillside immediately south of the ORR target area and South Pistol Range.

Because the data set for surface soil contained 10 or more samples, the 95-percent upper confidence limit (UCL) on the arithmetic mean, which was based on the distribution of the data set, was selected as the EPC for the RME and CTE cases for non-lead exposures. EPCs were calculated following U.S. EPA's Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites (U.S. EPA, 2002) using the U.S. EPA's ProUCL guidance (U.S. EPA, 2007).

Because lead concentrations varied significantly over the site, the site was divided into three EUs to evaluate risks for lead: the Northern Zone (500- and 400-yard firing positions and dirt mound), the Central Zone (300-, 200-, and 100-yard firing positions and former East and West Trap Ranges), and the Southern Zone (main targets and barricade, hillside impact area, and former South Pistol Range). All of these areas were used for small arms firing activities including rifle, pistol and trap shooting. As per U.S. EPA guidance (2008), the average concentrations in these areas were used to assess risks for lead.

6.3.4 Chemical Intake Estimation

The methodologies and techniques used to estimate exposure intakes are presented in this section. Intakes for the identified potential receptor groups were calculated using current U.S. EPA risk assessment guidance (e.g., 1991, 1997, and 2004) and are presented in the risk assessment spreadsheets in Appendix E. The quantitative exposure parameter and risk assessment calculations are presented in RAGS Part D format tables (Appendix E).

Non-carcinogenic intakes were estimated using the concept of an average annual exposure. Carcinogenic intakes were calculated as an incremental lifetime exposure, which assumed a life expectancy of 70 years. Assumptions regarding exposure are presented in Tables 6-5 and 6-6 for the RME and CTE scenarios, respectively.

6.3.4.1 Dermal Contact with Soil

Direct physical contact with soil may result in the dermal absorption of chemicals. Exposures associated with the dermal route are estimated using the following equation and exposure factors (U.S. EPA, 2004):

$$\text{Intake}_{si} = \frac{(C_{si})(SA)(AF)(ABS)(CF)(EF)(ED)}{(BW)(AT)}$$

where:

Intake_{si}	=	amount of chemical "i" absorbed during contact with soil (mg/kg/day)
C_{si}	=	concentration of chemical "i" in soil (mg/kg)
SA	=	skin surface area available for contact (cm^2/day)
AF	=	skin adherence factor (mg/cm^2)
ABS	=	absorption factor (dimensionless)
CF	=	conversion factor (1×10^{-6} kg/mg)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)
		for non-carcinogens, AT = ED x 365 days/year
		for carcinogens, AT = 70 years x 365 days/year

Exposed surface areas of the body available for dermal contact are determined on a receptor-specific basis because they correspond with assumed human activities and clothing worn during exposure events. Current guidance documents (U.S. EPA, 1997 and 2004) were used to develop the default assumptions concerning the amount of skin surface area available for contact for a receptor. To maintain consistency from project to project, input parameters previously used for other NSWC Crane risk assessments (e.g., TtNUS, 2003a, 2003b, and 2005) were reviewed when developing the exposed surface areas. The rationales used to select the skin areas were as follows:

- For construction workers, maintenance workers, and occupational workers exposed to surface soil, the surface area available for soil contact was assumed to be the head, hands, and forearms. The skin surface area is 3,300 cm^2 for the CTE and RME scenarios. These values represent the 50^{th}-percentile areas for the head, hands, and forearms (U.S. EPA, 2004).

- For adolescent trespassers, 25 percent of the total body surface area for an adolescent (aged 6 to 16) was assumed to be available for surface soil contact. The RME value (3,820 cm^2) was derived from the 95^{th}-percentile surface area data, and the CTE value (3,100 cm^2) was derived from the 50^{th}-percentile data, as provided in Table 6-6 of the Exposure Factors Handbook (U.S. EPA, 1997).

- For adult recreational users assumed to be exposed to soil, the exposed surface area available for contact was the sum of the head, arms, hands, lower legs, and feet of an adult male. This skin surface area is 9,070 cm^2 for the RME and CTE scenarios. This value represents the 50^{th}-percentile areas for the arms, hands, lower legs, and feet (U.S. EPA, 1997). For a small child recreational user (0 to 6 years old), it was assumed that 50 percent of the body surface area was exposed to surface soil (i.e., 3,300 cm^2). This value represents the 50^{th}-percentile areas presented in Table 6-6 of the Exposure Factors Handbook (U.S. EPA, 1997).

- For adult residents exposed to surface soil, the exposed surface area available for contact is the U.S. EPA recommended value of 5,700 cm^2 for the RME and CTE scenarios (2004). This value assumes that the adult resident is wearing a short-sleeved shirt, shorts, and shoes; therefore, the exposed skin surface is limited to the head, hands, forearms, and lower legs. For a child resident, the recommended value of 2,800 cm^2 was used as the exposed skin surface area for the RME and CTE scenarios (2004). This value assumes that the child resident is wearing a short-sleeved shirt, shorts, and no shoes; therefore, the exposed skin surface area is limited to the head, hands, forearms, lower legs, and feet.

The following values of soil adherence factors provided in RAGS Part E (U.S. EPA, 2004) were used to evaluate risks from exposure to soil:

- Construction workers - 0.3 mg/cm^2 for the RME and 0.1 mg/cm^2 for the CTE. These values are the 95^{th}-percentile and geometric mean values for construction workers, respectively (U.S. EPA, 2004 and 2002).

- Maintenance workers and occupational workers - 0.2 mg/cm^2 for the RME and 0.02 mg/cm^2 for the CTE (U.S. EPA, 2004).

- Adolescent trespassers, child recreational users, and child residents - 0.2 mg/cm^2 for the RME and 0.04 mg/cm^2 for the CTE. These values are the 95^{th}-percentile and geometric mean values presented for soccer players (teens) playing in moist conditions (U.S. EPA, 2004).

- Adult recreational users and adult residents - 0.07 mg/cm^2 for the RME and 0.01 mg/cm^2 for the CTE (U.S. EPA, 2004).

For the constituents identified as COPCs in soil at UXO No. 7, the following absorption factors were used (U.S. EPA, 2004):

- PAHs - 0.13
- Arsenic - 0.03

As indicated in RAGS Part E, absorption factors for other metals have not been developed due to insufficient data to support default values. Therefore, risks from dermal absorption of metals (other than arsenic and cadmium) from soil were not quantified in this risk assessment. The uncertainty associated with the omission of these constituents is discussed in the uncertainty analysis.

6.3.4.2 Incidental Ingestion of Soil

Incidental ingestion of soil by potential receptors coincides with dermal exposure. Exposures associated with incidental ingestion were estimated in the following manner (U.S. EPA, 1989):

$$\text{Intake}_{si} = \frac{(C_{si})(IR_s)(FI)(EF)(ED)(CF)}{(BW)(AT)}$$

where:

$Intake_{si}$	=	intake of contaminant "i" from soil (mg/kg/day)
C_{si}	=	concentration of contaminant "i" in soil (mg/kg)
IR_S	=	ingestion rate (mg/day)
FI	=	fraction ingested from contaminated source (dimensionless)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
CF	=	conversion factor (1×10^{-6} kg/mg)
BW	=	body weight (kg)
AT	=	averaging time (days); for non-carcinogens, AT = ED x 365 days/year for carcinogens, AT = 70 years x 365 days/year

The same exposure frequencies and durations used in the estimation of dermal intakes were used to estimate exposure via incidental ingestion. Default values of 1.0 were used for the fraction of soil ingested from the source for both the RME and CTE scenarios.

6.3.4.3 Inhalation of Air Containing Fugitive Dust/Volatiles Emitted from Soil

As stated previously, the inhalation pathway is quantitatively evaluated for chemicals identified as COPCs in this HHRA because concentrations of several chemicals exceeded U.S. EPA SSLs for migration from soil to air for construction workers. The chemical intakes for inhalation exposures are determined using the concentration of the contaminant in air. Intakes of particulates from soil were calculated using the following equation (U.S.EPA, December 1991, July 1996, and December 2002):

$$Intake_{ai} = [Cs_i \times IR_a \times ET \times EF \times ED \times (1/PEF) / (BW \times AT)$$

where:

$Intake_{ai}$	=	intake of chemical "i" from air via inhalation (mg/kg/day)
Cs_i	=	concentration of chemical "i" in soil (mg/kg)
IR_a	=	inhalation rate (m^3/hour or day)
ET	=	exposure time (hours/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (year)
PEF	=	particulate emission factor (m^3/kg)
BW	=	body weight (kg)

AT	=	averaging time (days);
		for noncarcinogens, AT = ED x 365 days/year
		for carcinogens, AT = 70 yr x 365 days/year

The concentration of a chemical in air is calculated using the methodology provided in the U.S. EPA's Soil Screening Guidance (1996 and 2002) and measured soil concentrations, site-specific information, chemical-specific data, and model default values. An inhalation rate of 2.5 m^3 per hour for the RME and CTE (U.S. EPA, 1997 and 2002) was used to calculate inhalation intakes for constructions workers assuming an 8-hour workday.

6.3.4.4 Summary of Exposure Parameters

A summary of the exposure input parameters for all exposure pathways is presented in Tables 6-5 and 6-6 for the identified potential receptor groups at UXO 7. In general, standard default parameters (e.g., U.S. EPA, 1991 and 1997), which combine mid-range and upper-end exposure factors, were used to assess RME conditions. The CTE was assessed primarily by the use of mid-range exposure factors presented in current risk assessment guidance (U.S. EPA, 1989 and 1993).

6.3.5 Exposure to Lead

The equations and methodology presented in the previous section cannot be used to evaluate exposure to lead because of the absence of published dose-response parameters. Exposure to lead was assessed using the following models:

- The latest version of U.S. EPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model for lead (2002). This model is typically used to evaluate lead exposure assuming a residential land use scenario.

- The U.S. EPA's TRW Model for Lead (2003). This model is typically used to evaluate lead exposure assuming a non-residential land use scenario.

The IEUBK Model for lead is designed to estimate blood levels of lead in children (under 7 years of age) based on either default or site-specific input values for air, drinking water, diet, dust, and soil exposure. Studies indicate that infants and young children are extremely susceptible to adverse effects from exposure to lead. Considerable behavioral and developmental impairments have been noted in children with elevated blood-lead levels. The threshold for toxic effects from this chemical is believed to be in the range of 10 to 15 micrograms per deciliter (µg/dL). Blood-lead levels greater than 10 µg/dL are considered to be a "concern."

For UXO 7, the IEUBK Model for lead was used to address exposure to lead in children when detected soil concentrations exceeded the OSWER soil screening level of 400 mg/kg for residential land use (U.S. EPA, 1994). Average chemical concentrations and default parameters for some input parameters were used in the evaluation. Estimated blood-lead levels and probability density histograms are presented as support documentation in Appendix E.

Non-residential adult exposure to lead in soil was evaluated using U.S. EPA's TRW Model for lead (2003). In this model, adult exposure to lead in soil is addressed by an evaluation of the relationship between the site soil lead concentration and the blood-lead concentration in the developing fetuses of adult women. The adult lead model (ALM) generates a spreadsheet for each exposure scenario that is evaluated (e.g., industrial, recreational). The output of the spreadsheet is the probability that the blood-lead concentration in the fetus exceeds 10 µg/L.

No models are currently available to evaluate the periodic exposure of adolescent trespassers to lead. Therefore, the results of the IEUBK Model for children were used to qualitatively assess exposure of this receptor.

6.4 TOXICITY ASSESSMENT

The objective of the toxicity assessment is to identify the potential health hazards and adverse effects of chemicals in exposed populations. Quantitative estimates of the relationship between the magnitude and type of exposures and the severity or probability of human health effects are defined for the identified COPCs. Quantitative toxicity values determined during this component of the risk assessments were integrated with outputs of the exposure assessments to characterize the potential for the occurrence of adverse health effects for each receptor group.

The toxicity value used to evaluate non-carcinogenic health effects is the RfD; carcinogenic effects are quantified using the CSF.

6.4.1 <u>Toxicity Criteria</u>

Oral and inhalation RfDs and CSFs used in the HHRA for UXO No. 7 were obtained from the following primary literature sources (U.S. EPA, 2003):

- Integrated Risk Information System (IRIS) (online).

- U.S. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs) – The Office of Research and Development/National Center for Environmental Assessment (NCEA) Superfund Health Risk Technical Support Center develops PPRTVs on a chemical-specific basis when requested by U.S. EPA's Superfund program.

- Other Toxicity Values – These sources include but are not limited to California Environmental Protection Agency (CA EPA) toxicity values, Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs), and the Annual Health Effects Assessment Summary Tables (HEAST) (U.S. EPA, 1997).

Although RfDs and CSFs can be found in several toxicological sources, U.S. EPA's IRIS online database is the preferred source of toxicity values. This database is continuously updated and values presented have been verified by U.S. EPA. The U.S. EPA Region 9 PRG Tables and Region 3 Risk-Based Concentration (RBC) Tables were also used as a source of toxicity criteria when these criteria were not available from the aforementioned references. The RfDs and CSFs for the constituents selected as COPCs for UXO 7 are presented in Tables 6-7 through 6-10.

6.4.2 Toxicity Criteria for Dermal Exposure

RfDs and CSFs found in literature are typically expressed as administered doses; therefore, these values are considered inappropriate for estimating the risks associated with dermal routes of exposure. Oral dose-response parameters based on administered doses must be adjusted to absorbed doses before the evaluation of estimated dermal exposure intakes is made.

The adjustment from administered to absorbed dose was made using chemical-specific absorption efficiencies published in available guidance (i.e., U.S. EPA, 2004 [the primary reference], IRIS, ATSDR toxicological profiles, etc.) and the following equations:

$$RfD_{dermal} = (RfD_{oral})(ABS_{GI})$$

$$CSF_{dermal} = (CSF_{oral}) / (ABS_{GI})$$

where: ABS_{GI} = absorption efficiency in the gastrointestinal tract

Absorption efficiencies used in the risk assessment reflect U.S. EPA's current dermal assessment guidance (2004).

6.4.3 Toxicity of Carcinogenic PAHs

Limited toxicity values are available to evaluate the carcinogenic effects from exposure to PAHs. The most extensively studied PAH is benzo(a)pyrene, which is classified by U.S. EPA as a probable human carcinogen. Although CSFs are available for benzo(a)pyrene, insufficient data are available to calculate CSFs for other carcinogenic PAHs. Toxic effects for these chemicals were evaluated using the concept of estimated orders of potential potency, which relate the potency of the other potentially carcinogenic PAHs to the potency of benzo(a)pyrene, as presented in current U.S. EPA guidance (1993). The equivalent oral and inhalation CSFs for these chemicals were derived by multiplying the CSFs for benzo(a)pyrene by the orders of potential potency.

6.4.4 Chemicals that Act via a Mutagenic Mode of Action

The risks for carcinogenic PAHs were calculated using the U.S. EPA's 2005 Guidelines for Carcinogen Risk Assessment (2005a) and Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (2005b) because of special considerations for carcinogens that act via a mutagenic mode of action (e.g., PAHs).

The aspect of the new guidelines that most directly affects the calculation of cancer risks is the use of age-dependent adjustment factors (ADAFs) to adjust cancer risk for receptors whose exposure includes early life. For chemicals that the U.S. EPA has determined to be carcinogenic via a mutagenic mode of action, special adjustments are applied in estimating cancer risks. For example, vinyl chloride has a chemical-specific adjustment, as described in IRIS. For the other chemicals (e.g., PAHs), where no chemical-specific ADAFs have been developed, default ADAFs are used: 10 for ages 0 to 2, 3 for ages 2 to 16, and no adjustment for ages 16 and up. In October 2006, U.S. EPA Region 3 began to use these default ADAFs to calculate RBCs for a number of chemicals, including PAHs. The methodology used to calculate risks for carcinogenic PAHs in this risk assessment followed the examples provided in the Region 3 document titled Derivation of RBCs for Carcinogens that Act Via a Mutagenic Mode of Action and Incorporate Default ADAFs (U.S. EPA, 2006). For UXO 7, this methodology was used to calculate risks for child and adult residents, child and adult recreational users, and adolescent trespassers. The mutagenic mode of action calculations are provided in Appendix E.

6.5 RISK CHARACTERIZATION

This section provides a characterization of the potential human health risks associated with potential exposures to COPCs at UXO 7. Section 6.5.1 outlines the methods used to quantitatively estimate the type and magnitude of potential risks for human receptors. A summary of the risk characterization for the UXO 7 is provided in Section 6.5.2.

6.5.1 Quantitative Analysis

Quantitative estimates of risk were calculated according to risk assessment methods outlined in U.S. EPA guidance (1989). Lifetime cancer risks are expressed in the form of dimensionless probabilities, referred to as ILCRs, based on CSFs. Non-carcinogenic risk estimates are presented in the form of HQs determined through a comparison of intakes with published RfDs.

ILCR estimates were generated for each carcinogenic COPC using estimated exposure intakes and published CSFs, as follows:

$$\text{ILCR} = (\text{Estimated Exposure Intake})(\text{CSF})$$

If the above equation resulted in an ILCR greater than 0.01, the following equation was used to calculate cancer risk estimates:

$$\text{ILCR} = 1\text{-}[\exp(\text{-Estimated Exposure Intake})(\text{CSF})]$$

An ILCR of 1×10^{-6} indicates that the exposed receptor has a one-in-one-million chance of developing cancer under the defined exposure scenario. Alternatively, such a risk may be interpreted as representing one additional case of cancer in an exposed population of one million persons.

As mentioned previously, non-carcinogenic risks were assessed using the concepts of HQs and HIs. The HQ for a non-carcinogenic COPC is the ratio of the estimated intake to the RfD, as follows:

$$\text{HQ} = (\text{Estimated Exposure Intake}) / (\text{RfD})$$

An HI was generated by summing the individual HQs for all COPCs. The HI is not a mathematical prediction of the severity of toxic effects and therefore is not a true "risk"; it is simply a numerical indicator of the possibility of the occurrence of non-carcinogenic (threshold) effects.

6.5.1.1 Comparison of Quantitative Risk Estimates to Benchmarks

To interpret quantitative risks and to aid risk managers in determining the need for remediation at a site, quantitative risk estimates were compared to typical benchmarks. Calculated ILCRs were interpreted using the U.S. EPA's "target risk range" (1×10^{-6} to 1×10^{-4}), and HIs were evaluated using a value of 1.0.

U.S. EPA has defined the range of 1×10^{-6} to 1×10^{-4} as the ILCR target risk range for most hazardous waste sites addressed under CERCLA and RCRA. IDEM has defined the same range for the non-default evaluation under their RISC program. Individual or cumulative ILCRs greater than 1×10^{-4} will typically not be considered as protective of human health and ILCRs less than 1×10^{-6} will typically be regarded as protective. Risk management decisions are necessary when the ILCR is within the 1×10^{-6} to 1×10^{-4} cancer risk range.

An HI exceeding unity (1.0) indicates that there may be potential non-carcinogenic health risks associated with exposure. If an HI exceeded unity, a segregation of target organ effects associated with exposure to the COPCs was performed. Only those chemicals that affect the same target organ(s) or exhibit similar critical effect(s) are regarded as truly additive. Consequently, it may be possible for a cumulative HI to exceed 1.0, but no adverse health effects are anticipated if the COPCs do not affect the same target organ or exhibit the same critical effect.

6.5.2 <u>Results of the Risk Characterization</u>

This section contains a summary of the results of the risk characterization for UXO 7. Quantitative risk estimates for potential human receptors were developed for those chemicals identified as COPCs. Uncertainties associated with the risk estimates are discussed in Section 6.6. The exposure assessment and toxicity assessment methodology used to calculate the risks presented in this section is provided in Sections 6.3 and 6.4. Potential cancer risks and HIs were calculated for current/future maintenance workers, occupational workers, adolescent trespassers, future construction workers, child recreational users, adult recreational users, and on-site residents under the RME and CTE scenarios and are summarized in Tables 6-11 and 6-12, respectively. Example calculations are presented in Appendix E, and the results of the risk assessment in RAGS Part D format are also included in Appendix E.

6.5.2.1 Non-Carcinogenic Risks - RME

The target organ-specific HIs for all receptors, with the exception of construction workers, potentially exposed to COPCs in surface soil at UXO 7 were less than unity (1.0), indicating that adverse non-carcinogenic health effects are not anticipated for these receptors under the defined RME exposure conditions.

The HI for the construction worker was 6. This risk is primarily due to the exposure to manganese by inhalation of dust and particulates (HI = 5). However, as shown in Tables 6-1 and 6-2, the concentrations of manganese in surface soil at UXO 7 were found to be within background levels at NSWC Crane. Consequently, the risk estimates for manganese are not related to past site activities.

As shown in Table 6-11, the total HI for the future child resident was 3. However, the target organ analysis presented in Appendix E shows that the target organ-specific HIs for this receptor are less than 1. Therefore, adverse non-carcinogenic health effects are not anticipated for the child resident under the defined RME exposure conditions.

6.5.2.2 Carcinogenic Risks – RME

Cumulative ILCRs for all potential receptors, except for hypothetical future residents, assumed to be exposed to COPCs in surface soil at UXO 7 were within the U.S. EPA target risk range, $1x10^{-6}$ to $1x10^{-4}$.

The total residential ILCR (child + adult ILCR = $3x10^{-4}$) exceeded the target risk range. The primary contributors to the ILCR were carcinogenic PAHs (child + adult ILCR = $2.3x10^{-4}$), which accounted for approximately 90 percent of the total residential ILCR. Concentrations of PAHs in samples X7SS1210002 and X7SS1230002 were primarily responsible for the elevated cancer risks. Arsenic accounted for the remainder of the total ILCR. As stated previously, future residents are unlikely receptors at UXO 7. ILCRs for the more likely receptors at the site (e.g., maintenance workers or future construction workers) were at the lower end of the U.S. EPA's target risk range.

6.5.2.3 Non-Carcinogenic Risks – CTE

The target organ-specific HIs for all receptors, with the exception of construction workers, were less than unity (1.0), indicating that adverse non-carcinogenic health effects are not anticipated for these receptors under the defined RME exposure conditions.

The HI for the construction worker was 6. This risk is primarily due to the exposure to manganese by inhalation of dust and particulates (HI = 5). However, as discussed previously, the concentrations of manganese in surface soil at UXO 7 were found to be within background levels at NSWC Crane, and the risk estimates for manganese are likely not related to past site activities.

6.5.2.4 Carcinogenic Risks – CTE

Cumulative ILCRs for all potential receptors were less than or within the U.S. EPA target risk range, $1x10^{-6}$ to $1x10^{-4}$.

6.5.2.5 Evaluation of Exposure to Lead

Lead was identified as a COPC for surface soil at UXO 7 because the maximum detected lead concentration (1,160 mg/kg) exceeded the 400 mg/kg OSWER soil screening level for residential land use.

As discussed in Section 6.3.5, the methodology used to calculate the risks presented in Sections 6.3.4 cannot be used to evaluate exposure to lead because of the absence of published dose-response parameters. Exposure to lead was assessed using the U.S. EPA's IEUBK Model for lead and the U.S. EPA’s TRW ALM. The IEUBK Model is typically used to evaluate lead exposure assuming a residential land use scenario, and the TRW Model is used to evaluate lead exposure for non-residential land use scenarios.

The blood-lead concentration of a receptor is considered a key indicator of the potential for adverse health effects. The IEUBK and TRW Models calculate the probability of a receptor’s blood-lead level exceeding 10 µg/dL. The U.S. EPA goal is to limit the childhood risk of exceeding a 10 µg/dL blood-lead concentration to 5 percent.

Current U.S.EPA guidance (2008) recommends using the average concentration to evaluate exposure to lead. Therefore, the average lead concentration in the Northern Zone (278 mg/kg) and model default values for other model parameters were used in the IEUBK and ALM modeling. The average concentration in the Northern Zone of the site was used in the model calculations because this area had the highest average of the three zones. The results of the IEUBK Model and ALM evaluations are presented in the following sections.

IEUBK Model Results

IEUBK Model Results for UXO 7 Surface Soil

Lead Concentration	Predicted Geometric Mean Blood-Lead Level (µg/dL) (U.S. EPA Goal = 10)	Probability of the Child Blood-Lead Level Exceeding 10 µg/dL (percent) (U.S. EPA Goal = 5%)
Soil - 278 mg/kg	4.1	2.8

The results of the IEUBK Model evaluation indicate that the estimated geometric mean blood-lead level for a child resident is 4.1 µg/dL, which is less than the established level of concern (10 µg/dL). Approximately 2.8 percent of children are expected to experience blood-lead levels greater than 10 µg/dL. This estimate is less than U.S. EPA's goal of limiting exposure to lead so that no more than 5 percent of exposed children have an estimated blood-lead level greater than the established level of concern (10 µg/dL). The IEUBK evaluation is conservative because it assumes exposure by a hypothetical child resident, which is unlikely to occur at UXO 7.

Adult Lead Model Results

Adult Lead Model Results for UXO 7 Surface Soil

Receptor	Predicted Geometric Mean Blood-Lead Level of a Worker (µg/dL) (U.S. EPA Goal = 10)	Probability of the Fetus of a Worker Having a Blood-Lead Level Exceeding 10 µg/dL (percent) (U.S. EPA Goal = 5%)
Construction Worker	2.0	1.9
Maintenance Worker	1.7	1.3
Occupational Worker	2.2	2.5
Adult Recreational User	1.9	1.7

As shown in the above table, the central estimate blood-lead levels of all receptors evaluated for exposure to the average concentration of lead in Northern Zone surface soil (278 mg/kg) were less than the U.S. EPA goal of 10 µg/dL. The probabilities that blood-lead levels of fetuses of adult workers and adult recreational users would be greater than 10 µg lead/dL of blood ranged from 1.7 to 2.1 percent. These estimates are less than the U.S. EPA's goal of limiting exposure to lead so that no more than 5 percent of exposed receptors have an estimated blood-lead level greater than the established level of concern (10 µg/dL).

Summary of Lead Model Evaluation

The IEUBK and ALM analyses of lead concentrations in surface soil at UXO 7 indicate that predicted blood levels for children, adult workers, adult recreational users, and their fetuses were acceptable (i.e., within U.S. EPA's goals and the probabilities of exceeding these goals from exposure to lead in soil were less than the U.S. EPA goal of 5 percent). The results of the IEUBK and ALM modeling are presented in Appendix E. Because the results for the Northern Zone were less than U.S. EPA goals, it was not necessary to estimate risks for the Central and Southern Zones because the average lead concentrations in these areas (184 and 22.9 mg/kg, respectively) were less than the average concentration in the Northern Zone (278 mg/kg).

6.6 UNCERTAINTY ANALYSIS

There is uncertainty associated with all aspects of the baseline HHRA. A summary of the uncertainties, including a discussion of how they may affect the final risk estimates, is provided in this section.

Uncertainty in the selection of COPCs is related to the current status of the predictive databases, the grouping of samples, the numbers, types and distributions of samples, and the procedures used to include or exclude constituents as COPCs. Uncertainty associated with the exposure assessment includes the values used as input variables for a given intake route or scenario, the assumptions made to determine EPCs, and the predictions regarding future land use and population characteristics. Uncertainty in the toxicity assessment includes the quality of the existing toxicity data needed to support dose-response relationships and the weight of evidence used to determine the carcinogenicity of COPCs. Uncertainty in risk characterization includes that associated with exposure to multiple chemicals and the cumulative uncertainty from combining conservative assumptions made in earlier steps of the risk assessment process.

Whereas there are various sources of uncertainty, the direction of uncertainty can be influenced by the assumptions made throughout the risk assessment, including selection of COPCs and selection of values for dose-response relationships. Throughout the entire risk assessment, assumptions are biased toward a margin of safety so that the final calculated risks are overestimated.

Generally, risk assessments include two types of uncertainty; measurement and informational uncertainty. Measurement uncertainty refers to the usual variance that accompanies scientific measurements. For example, this type of uncertainty is associated with analytical data collected for each site. The risk assessment reflects the accumulated variances of the individual values used.

Informational uncertainty is associated with inadequate availability of information needed to complete the toxicity and exposure assessments. Often, this gap is significant, such as the absence of information on the effects of human exposure to low doses of a chemical, on the biological mechanism of action of a chemical, or on the behavior of a chemical in soil.

After the risk assessment is complete, the results must be reviewed and evaluated to identify the types and magnitude of uncertainty involved. Reliance on results from a risk assessment without consideration of uncertainties, limitations, and assumptions inherent in the process can be misleading. For example, to account for uncertainties in the development of exposure assumptions, conservative estimates must be made to ensure that the particular assumptions made are protective of sensitive subpopulations or the maximum exposed individuals. If a number of conservative assumptions are combined in an exposure model, the resulting calculations can propagate the uncertainties associated with those assumptions, thereby producing a much larger uncertainty for the final results. This uncertainty is biased toward over predicting both carcinogenic and non-carcinogenic risks. Thus, both the results of the risk assessment and the uncertainties associated with those results must be considered when making risk management decisions.

This interpretation is especially relevant when the risks exceed the point of departure for defining "acceptable" risk. For example, when risks calculated using a high degree of uncertainty are less than an acceptable risk level (i.e., 10^{-4} to 10^{-6}), the interpretation of no significant risk is typically straightforward. However, when risks calculated using a high degree of uncertainty exceed an acceptable risk level (i.e., 10^{-4}), a conclusion can be difficult unless uncertainty is considered.

6.6.1 Uncertainty in Selection of COPCs

The most significant issues related to uncertainty in COPC selection were the usability of existing databases (i.e., the use of validated and unvalidated sample results [only validated data were used in this risk assessment] and the completeness, precision, and accuracy of the data set), the inclusion of chemicals potentially attributable to background in the quantitative risk assessment, the screening levels used, and the absence of screening levels for a few chemicals detected in surface soil. A brief discussion of each of these issues is provided in the remainder of this section.

Usability of Existing Databases

Data from samples collected during the 2007 RFI were used to assess risks to potential human receptors. The RFI samples were biased because they were collected in areas of known or suspected contamination. Because the sampling was biased, the uncertainty is expected to be minimal and risks are not likely to be underestimated. The data were validated according to U.S.EPA National Validation Functional Guidelines for Organic Data Review (1999), the Laboratory and Data Validation Functional Guidelines for Evaluation of Inorganic Analysis (1994), and TtNUS SOPs. Only, fixed-base analytical results from the field investigations were used in the quantitative risk evaluation. All detected concentrations with "J" qualifiers were considered as positive detections and were used in the risk evaluation. The use of estimated data adds to the uncertainty associated with the risk assessment; however, the associated uncertainty is expected to be negligible compared to the other uncertainties inherent in the risk evaluation process (e.g., uncertainties with land uses, exposure scenarios, toxicological criteria, etc.). Lead data from 189 XRF samples were used to define the nature and extent of lead contamination but were not used in the quantitative risk assessment. Omission of the XRF samples from the risk assessment is expected to result in an overestimation of risks for lead because, in general, the samples with elevated XRF lead concentrations were sent to the laboratory. Consequently, samples with higher concentrations were used to determine the EPC for lead. For example, the average concentration of lead from the laboratory samples in the Northern Zone was 278 mg/kg but the average of the XRF samples in this area was 176 mg/kg.

COPC Screening Levels

The use of risk-based screening concentrations, based on conservative land use scenarios (i.e., residential land use), corresponding to an ILCR of 10^{-6} and HI of 0.1 should ensure that all the significant contributors to risk from a site were evaluated. The elimination of chemicals present at concentrations that correspond to an ILCR less than 10^{-6} and an HI less than 0.1 should not affect the final conclusions of the risk assessment because these chemicals are not expected to cause a potential health concern at the detected concentrations.

Chemicals without Established Screening Levels

Risk-based screening levels are currently not available for some constituents [e.g., acenaphthylene, 2-methylnaphthalene, benzo(g,h,i)perylene, and phenanthrene]. Therefore, surrogates with similar chemical structures were selected for these chemicals. In the COPC screening, acenaphthene was used as a surrogate for acenaphthylene, naphthalene was used as a surrogate for 2-methylnaphthalene, and pyrene was selected as a surrogate for benzo(g,h,i)perylene and phenanthrene. Applying toxicity values for one compound to another adds to uncertainty in the risk assessment both in regard to the selection of COPCs and the subsequently calculated risks.

Because of a lack of inhalation toxicity data (i.e., inhalation CSFs and RfDs), U.S. EPA SSLs for the migration from soil to air pathway are currently not available for number of constituents detected in soil at UXO 7. This may result in an underestimation of risk for the inhalation exposure pathway. The underestimation is likely to be negligible because the constituents that lack toxicity data are typically not a concern for inhalation. In addition, the uncertainty is expected to be small because potential risks associated with exposures via inhalation are typically orders of magnitude lower than those associated with exposures via incidental ingestion and dermal contact with soil. A comparison of the screening criteria for direct contact exposures with the screening criteria for migration from soil to air shows that, in most cases, the direct contact screening criteria are at least an order of magnitude lower than the soil to air migration screening criteria for the same chemical. If there are unacceptable risks resulting from inhalation exposures, there are usually also unacceptable risks from exposures via the incidental ingestion and dermal contact exposure pathways.

Chemicals Potentially Attributable to Background

Background concentrations were not a consideration in the COPC selection process. If the maximum concentration of a chemical exceeded its respective screening level, that chemical was selected as a COPC and evaluated in the quantitative risk assessment. However, background soil concentrations have been characterized for the facility. The implications of not including background screening in the COPC selection process are discussed in the following paragraph.

Eleven metals (aluminum, antimony, arsenic, barium, chromium, copper, iron, lead, manganese, thallium, and vanadium) were identified as COPCs for quantitative risk evaluation. As shown in Tables 6-1 and 6 2, the concentrations of barium, manganese, and thallium were determined to be within background levels at NSWC Crane. This is important for this risk assessment because manganese (by inhalation) was found to be the major risk driver for the construction worker scenario. As shown in Table 6-11, the total HI for the construction worker was 6. If barium, manganese, and thallium had not been included in the quantitative risk assessment, the total HI would be 0.5, and the risks for this receptor would be acceptable. Based on the above analysis, the inclusion of these three metals in the quantitative risk assessment results in a significant overestimation of risk for the construction worker.

6.6.2 Uncertainty in the Exposure Assessment

Uncertainty in the exposure assessment arises because of the methods used to calculate EPCs, the determination of land use conditions, the selection of receptors and scenarios, and the selection of exposure parameters. Each of these is discussed below.

Land Use

The current land use patterns at NSWC Crane are well established, thereby limiting the uncertainty associated with land use assumptions. Land use at UXO 7 is currently limited and is expected to be limited in the future as long as NSWC Crane remains an open base (i.e., occupational workers, maintenance workers, and potential and infrequent trespassers are the only current and likely future receptors). To be conservative, risks to potential current and future construction workers, current and future recreational users, and hypothetical future residents were estimated for the site.

Exposure Point Concentrations

95-Percent UCLs were used to estimate risks for all COPCs (except lead) at UXO 7. Uncertainty is associated with the use of the 95-percent UCL on the mean concentration as the EPC. As a result of using the 95-percent UCL, the estimations of potential risk for the RME scenario are most likely overstated because the UCL is a representation of the upper limit that potential receptors would be exposed to over the entire exposure period. Uncertainty is also introduced when non-detects are assigned a value of one-half the sample-specific quantitation limit in the calculation of the EPC. This may either overstate or understate the risks to the receptors.

Exposure Routes and Receptor Identification

The determination of various receptor groups and exposure routes of potential concern was based on current land use observed at the site and anticipated future land use. Therefore, the uncertainty associated with the selection of exposure routes and potential receptors is minimal because they are considered to be well defined. Although hypothetical future residential exposure to soil was evaluated, this scenario it not expected to occur in the future. The evaluation of future residents was included primarily to aid in risk management decision making.

Exposure Parameters

Each exposure factor (for RME and CTE scenarios) selected for use in the risk assessment has some associated uncertainty. Generally, exposure factors are based on surveys of physiological and lifestyle profiles across the United States. The attributes and activities studied in these surveys generally have a broad distribution. To avoid underestimation of exposure, in most cases, U.S. EPA guidelines (1991 and 1993) on the RME receptor were used, which generally specify the use of the 95^{th} percentile for most parameters. Therefore, the selected values for the RME receptor represent the upper bound of the observed or expected habits of the majority of the population.

Generally, uncertainty can be assessed quantitatively for many assumptions made in determining factors for calculating exposures and intakes. Many of these parameters were determined from statistical analyses on human population characteristics. Often, the database used to summarize a particular exposure parameter (i.e., body weight) is quite large. Consequently, the values chosen for such variables in the RME scenario have low uncertainty.

Many of the exposure parameters used to calculate exposures and risks in this report were selected from a distribution of possible values, including U.S. EPA guidance (1991 and 1993) and dermal guidance (1997 and 2004). For the RME scenario, the value representing the 95^{th} percentile is generally selected for each parameter to ensure that the assessment bounds the actual risks from a postulated exposure. This risk number is used in risk management decisions but does not indicate what a more average or typical exposure might be or what risk range might be expected for individuals in the exposed population.

To address these issues, U.S. EPA (1992) suggested the use of the CTE receptor, whose intake variables are often set at approximately the 50^{th} percentile of the distribution. The risks for this receptor seek to incorporate the range of uncertainty associated with various intake assumptions. Some of the parameters presented in this risk assessment were estimated using professional judgment, although U.S. EPA does provide limited guidance for the CTE evaluation (1993).

6.6.3 Uncertainty in the Toxicological Evaluation

Uncertainties associated with the toxicity assessment (determination of RfDs and CSFs and use of available criteria) are presented in this section.

Derivation of Toxicity Criteria

Uncertainty associated with the toxicity assessment is associated with hazard assessment and dose-response evaluations for the COPCs. The hazard assessment deals with characterizing the nature and strength of the evidence of causation or the likelihood that a chemical that induces adverse effects in animals will also induce adverse effects in humans. Hazard assessment of carcinogenicity is evaluated as a weight-of-evidence determination using the U.S. EPA methods. Positive animal cancer test data suggest that humans contain tissue(s) that may manifest a carcinogenic response; however, the animal data cannot necessarily be used to predict the target tissue in humans. In the hazard assessment of non-cancer effects, however, positive animal data often suggest the nature of the effects (i.e., target tissues and type of effects) anticipated in humans.

Uncertainty in hazard assessment arises from the nature and quality of the animal and human data. Uncertainty is reduced when similar effects are observed across species, strain, sex, and exposure route; when the magnitude of the response is clearly dose related; when pharmacokinetic data indicate a similar fate in humans and animals; when postulated mechanisms of toxicity are similar for humans and animals; and when the COC is structurally similar to other chemicals for which the toxicity is more completely characterized.

Uncertainty in the dose-response evaluation includes the determination of a CSF for the carcinogenic assessment and derivation of an RfD for the non-carcinogenic assessment. Uncertainty is introduced from interspecies (animal to human) extrapolation, which, in the absence of quantitative pharmacokinetic or mechanistic data, is usually based on consideration of interspecies differences in basal metabolic rate. Uncertainty also results from intraspecies variation. Most toxicity experiments are performed with animals that are very similar in age and genotype, so intragroup biological variation is minimal, but the human population of concern may reflect a great deal of heterogeneity, including unusual sensitivity or tolerance to the COPC. Even toxicity data from human occupational exposure reflect a bias because only those individuals sufficiently healthy to attend work regularly (the "healthy worker effect") and those not unusually sensitive to the chemical are likely to be occupationally exposed. Finally, uncertainty arises from the quality of the key study and the database from which the quantitative estimate is derived. For cancer effects, the uncertainty associated with dose-response factors is mitigated by assuming the 95-percent upper bound for the slope factor. Another source of uncertainty in carcinogenic assessment is the method by which data from high doses in animal studies are extrapolated to the dose range expected for environmentally exposed humans. The linearized multistage model, which is used in nearly all quantitative estimations of human risk from animal data, is based on a nonthreshold assumption of carcinogenesis. Evidence suggests however, that epigenetic carcinogens, as well as many genotoxic carcinogens, have a threshold below which they are non-carcinogenic. Therefore, the use of the linearized multistage model is conservative for chemicals that exhibit a threshold for carcinogenicity.

For non-cancer effects, additional uncertainty factors may be applied in the derivation of the RfD to mitigate poor quality of the key study or gaps in the database. Additional uncertainty for non-cancer effects arises from the use of an effect level in the estimation of an RfD because this estimation is predicated on the assumption of a threshold less than which adverse effects are not expected. Therefore, an uncertainty factor is usually applied to estimate a no-effect level. Additional uncertainty arises in estimation of an RfD for chronic exposure from subchronic data. Unless empirical data indicate that effects do not worsen with increasing duration of exposure, an additional uncertainty factor is applied to the no-effect level in the subchronic study. Uncertainty in the derivation of RfDs is mitigated by the use of uncertainty and modifying factors that normally range between 3 and 10. The resulting combination of uncertainty and modifying factors may reach 1,000 or more.

The derivation of dermal RfDs and CSFs from oral values may cause uncertainty. This is particularly the case when no gastrointestinal absorption rates are available in the literature or when only qualitative statements regarding absorption are available.

Uncertainty Associated with Evaluation of the Dermal Exposure Pathway

According to RAGS Part E (U.S. EPA, 2004), risks for dermal absorption of inorganics in soil are to be quantitatively evaluated for arsenic and cadmium only. Therefore, risks from dermal exposure to aluminum, antimony, iron, manganese, thallium, and vanadium in soil were not quantified in the risk assessment. Consequently, potential risks for these media may be underestimated as a result of the exclusion of these constituents from the dermal risk assessment calculations. The following paragraphs provide further discussion regarding the uncertainty associated with the evaluation of the dermal absorption of metals from soil.

The model for dermal exposure to soil assumes that only a very thin layer of soil of constant thickness is available for contaminant transfer to the stratum corneum and that a constant amount of contaminant, proportional to the soil concentration, will be absorbed per unit area of skin and per exposure event. However, adherence to skin varies with such factors as particle size, soil type, and organic carbon content, and U.S. EPA (2004) has estimated that the absorbed dermal dose could vary by as much as a factor of 50 from the model estimates used to develop absorption factors.

Experimental determination of absorption rates indicates that interspecies differences are considerable, which, along with other variables related to condition and age of skin, differences in lag time, and site of application effects, yields appreciable uncertainty in estimated dermal exposures using published chemical-specific permeation functions. In addition, literature data indicate a variation by as much as a factor of 300 in chemical absorption rates for skin in different anatomical areas of the body. It should also be noted that children generally have greater absorption rates than adults.

Uncertainty Associated with Toxicity Criteria for Aluminum and Iron

NCEA provisional RfDs were used to evaluate non-carcinogenic effects from exposure to aluminum and iron. The provisional RfDs for these chemicals are based on allowable intakes rather than adverse effect levels. Therefore, there is some degree of uncertainty associated with the use of the RfDs. Some U.S. EPA regions (e.g., Region 1) consider the use of the oral RfD for aluminum and iron inappropriate and recommend that these metals not be evaluated quantitatively in risk assessments.

Uncertainty Associated with the RfD for Manganese

The oral RfD for manganese listed in the October 2007 Region 3 PRG table (0.02 mg/kg/day) was used to calculate risks for ingestion soil. However, there is some uncertainty in this RfD and how it is to be used. For example, U.S. EPA Region 1 has recommended an RfD of 0.07 mg/kg/day for exposure to manganese in soil based on discussions presented in IRIS. Consequently, use of 0.02 mg/kg/day to may overestimate risks from ingestion of soil by a factor of 3.5. This should have little effect the results of the risk assessment because the oral HQs calculated for manganese for all receptors were less than unity.

6.6.4 Uncertainty in the Risk Characterization

Uncertainty in risk characterization resulted from assumptions made regarding additivity of effects from exposure to multiple COPCs from various exposure routes. High uncertainty exists when summing non-cancer risks for several substances across different exposure pathways. This assumes that each substance has a similar effect and/or mode of action. Even when chemicals affect the same target organs, they may have different mechanisms of action or differ in their fate in the body, so additivity may not have been an appropriate assumption. However, the assumption of additivity was considered acceptable because in most cases it represented a conservative estimate of risk.

Risks to any individual may also have been overestimated by summing multiple assumed exposure pathway risks for any single receptor. Although every effort was made to develop reasonable scenarios, not all individual receptors may have been exposed via all pathways considered.

Also, the risk characterization did not consider antagonistic or synergistic effects. Little or no information was available to determine the potential for antagonism or synergism for the COPCs. Because chemical-specific interactions could not be predicted, the likelihood for risks to be over predicted or under predicted could not be defined, but the methodology used was based on current U.S. EPA guidance.

6.7 SUMMARY AND CONCLUSIONS

This section summarizes the results of the HHRA performed for UXO 7.

The baseline HHRA for UXO 7 was performed to characterize the potential risks to likely human receptors under current and potential future land use. Potential receptors under current land use are maintenance workers, occupational workers, and adolescent trespassers. Potential receptors under future land use are construction workers, child and adult recreational users, and hypothetical child and adult residents. Although future land use is likely to be the same as current land use, potential future receptors were evaluated in the baseline HHRA primarily for decision-making purposes.

The list of COPCs for direct contact with surface soil at UXO 7 is as follows:

- PAHs - benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene

- Inorganics - aluminum, antimony, arsenic, barium, copper, iron, lead, manganese, thallium, and vanadium

Risks for these COPCs were quantitatively evaluated in the risk assessment.

In addition to the COPCs based on direct contact listed above, COPCs were also identified for migration from soil to groundwater. The following constituents were identified as COPCs for migration from soil to groundwater:

- PAHs - benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, and indeno(1,2,3-cd)pyrene

- Inorganics - antimony, arsenic, barium, cadmium, chromium, cobalt, lead, manganese, nickel, selenium, and thallium

Risk Assessment Results for COPCs other than Lead

Quantitative estimates of noncarcinogenic and carcinogenic risks (HIs and ILCRs, respectively) were developed for potential human receptors.

Non-Carcinogenic Risks

The target organ-specific HIs for all receptors, with the exception of construction workers, potentially exposed to COPCs in surface soil at UXO 7 were less than unity (1.0), indicating that adverse non-carcinogenic health effects are not anticipated for these receptors under the defined RME exposure conditions.

The HI for the construction worker was 6. This risk is primarily due to the exposure to manganese by inhalation of dust and particulates. However, as shown in Tables 6-1 and 6-2, the concentrations of manganese in surface soil at UXO 7 were found to be within background levels at NSWC Crane. Consequently, the risk estimates for manganese are not likely related to past site activities.

Carcinogenic Risks

Cumulative ILCRs for all potential receptors, except for hypothetical future residents, assumed to be exposed to COPCs in surface soil at UXO 7 were within the U.S. EPA target risk range, $1x10^{-6}$ to $1x10^{-4}$.

The total residential ILCR (child + adult ILCR = $3x10^{-4}$) exceeded the target risk range. The primary contributors to the ILCR were carcinogenic PAHs. However, future residential exposures are unlikely to occur at UXO 7. ILCRs for the more likely receptors at the site (e.g., maintenance workers or future construction workers) were within U.S. EPA's target risk range (i.e., they were slightly greater than $1x10^{-6}$). Concentrations of PAHs in samples X7SS1210002 and X7SS1230002 were primarily responsible for the elevated residential cancer risks.

Risk Assessment Results for Exposure to Lead

Exposures to lead in surface soil at UXO 7 were evaluated using U.S. EPA's IEUBK and ALM Models based on the average lead concentration from fixed-base laboratory results. Risks for lead were evaluated for future child residents, construction workers, occupational workers, and adult recreational users. The IEUBK and ALM results indicated that predicted blood levels for children and for adult workers and adult recreational users and their fetuses were acceptable (i.e., within U.S. EPA's goals and the probabilities of exceeding these goals from exposure to lead in soil were less than the U.S. EPA goal of 5 percent).

In summary, no significant potential human health risks are expected for exposures to surface soil under current land use at UXO 7. Under future land use, non-carcinogenic and/or carcinogenic risks exceeded U.S. EPA risk benchmarks for future construction workers and hypothetical future residents. The risk to construction workers was due to exposure to manganese via inhalation of dust and particulates. As discussed in the risk assessment, the concentrations of manganese were found to be within background levels at NSWC Crane, and the risks are not considered to be related to past site activities. The risks for future residents were due to direct exposure to carcinogenic PAHs in surface soil under the unlikely assumption that UXO 7 was to be developed for residential use in the future.

TABLE 6-1

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR HUMAN HEALTH - DIRECT CONTACT WITH SURFACE SOIL
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration[1]	Maximum Concentration[1]	Units	Sample with Maximum Concentration	Frequency of Detection	Range of Non-Detects[2]	Concentration Used for Screening[3]	Site Above Background ?[4]	U. S. EPA Region 9 PRG (Residential)[5]	Potential ARAR/TBC[6]	COPC Flag	Rationale for Contaminant Deletion or Selection[7]
Semivolatile Organic Compounds													
91-57-6	2-methylnaphthalene	3.9 J	40	ug/kg	X7SS1210002	3/11	1.6 - 1.8	40	NA	5600 N[8]	630000	No	BSL
83-32-9	Acenaphthene	4.9 J	550 J	ug/kg	X7SS1210002	4/11	1.1 - 1.3	550	NA	370000 N	9500000	No	BSL
208-96-8	Acenaphthylene	27	27	ug/kg	X7SS1230002	1/11	0.63 - 0.75	27	NA	370000 N[9]	1100000	No	BSL
120-12-7	Anthracene	4.2 J	970	ug/kg	X7SS1210002	5/11	0.83 - 0.96	970	NA	2200000 N	47000000	No	BSL
56-55-3	**Benzo(a)anthracene**	10	6400	ug/kg	X7SS1210002	7/11	0.87 - 0.95	6400	NA	**150 C**	**5000**	**Yes**	ASL
50-32-8	**Benzo(a)pyrene**	14	8100 J	ug/kg	X7SS1210002	7/11	0.96 - 1	8100	NA	**15 C**	**500**	**Yes**	ASL
205-99-2	**Benzo(b)fluoranthene**	20	12000 J	ug/kg	X7SS1210002	7/11	0.87 - 0.95	12000	NA	**150 C**	**5000**	**Yes**	ASL
191-24-2	Benzo(g,h,i)perylene	5.7 J	2900 J		X7SS1210002	7/11	0.96 - 1	2900	NA	230000 N[10]	NA	No	BSL
207-08-9	**Benzo(k)fluoranthene**	6.4 J	4700 J	ug/kg	X7SS1210002	7/11	0.45 - 0.49	4700	NA	**1500 C**	50000	**Yes**	ASL
218-01-9	Chrysene	13	7400	ug/kg	X7SS1210002	7/11	0.83 - 0.9	7400	NA	15000 C	500000	No	BSL
53-70-3	**Dibenzo(a,h)anthracene**	18	970 J	ug/kg	X7SS1210002	4/11	1 - 1.2	970	NA	**15 C**	**500**	**Yes**	ASL
206-44-0	Fluoranthene	14	8700	ug/kg	X7SS1210002	7/11	0.83 - 0.9	8700	NA	230000 N	6300000	No	BSL
86-73-7	Fluorene	4.6 J	270	ug/kg	X7SS1210002	4/11	0.64 - 0.74	270	NA	270000 N	6300000	No	BSL
193-39-5	**Indeno(1,2,3-cd)pyrene**	4.7 J	2900 J	ug/kg	X7SS1210002	7/11	1.2 - 1.3	2900	NA	**150 C**	5000	**Yes**	ASL
85-01-8	Phenanthrene	21	4900	ug/kg	X7SS1210002	5/11	1 - 1.2	4900	NA	230000 N[10]	470000	No	BSL
129-00-0	Pyrene	3.2 J	14000	ug/kg	X7SS1210002	8/11	1 - 1.1	14000	NA	230000 N	4700000	No	BSL
Inorganics													
7429-90-5	**Aluminum**	7910	19400	mg/kg	X7SS1270002,	29/29	---	19400	Yes	**7600 N**	NA	**Yes**	ASL
7440-36-0	**Antimony**	0.21 J	96.2 J	mg/kg	X7SS0390002	26/29	0.38 - 0.71	96.2	Yes	**3.1 N**	140	**Yes**	ASL
7440-38-2	**Arsenic**	3.86	17	mg/kg	X7SS1830002	29/29	---	17	Yes	**0.39 C**	**3.9**	**Yes**	ASL
7440-39-3	**Barium**	56.2	949	mg/kg	X7SS0040002	29/29	---	949	No	**540 N**	63000	**Yes**	ASL
7440-41-7	Beryllium	0.407	1.35	mg/kg	X7SS0030002	29/29	---	1.35	Yes	15 N	680	No	BSL
7440-43-9	Cadmium	0.387	2.21	mg/kg	X7SS1750002	29/29	---	2.21	No	3.7 N	12	No	BSL
7440-70-2	Calcium	735	26700	mg/kg	X7SS0390002	29/29	---	26700	No	NA	NA	No	NUT
7440-47-3	Chromium	10.2	66.6	mg/kg	X7SS0030002	29/29	---	66.6	Yes	210 C[11]	430[12]	No	BSL
7440-48-4	Cobalt	6.79	22.8	mg/kg	X7SS1820002	29/29	---	22.8	No	140 N[13]	NA	No	BSL
7440-50-8	**Copper**	6.34	427	mg/kg	X7SS0190002	29/29	---	427	Yes	**310 N**	14000	**Yes**	ASL
7439-89-6	**Iron**	12200	90700	mg/kg	X7SS0030002	29/29	---	90700	Yes	**5500 N**	NA	**Yes**	ASL
7439-92-1	**Lead**	10.3	1160	mg/kg	X7SS0550002	29/29	---	1160	Yes	**400**	**400**	**Yes**	ASL
7439-95-4	Magnesium	723	7000	mg/kg	X7SS0390002	29/29	---	7000	No	NA	NA	No	NUT
7439-96-5	**Manganese**	334	1370	mg/kg	X7SS0120002	29/29	---	1370	No	**180 N**	NA	**Yes**	ASL
7440-02-0	Nickel	8.75	50.2	mg/kg	X7SS0030002	29/29	---	50.2	Yes	160 N	6900	No	BSL
7440-09-7	Potassium	476	2380	mg/kg	X7SS1670002	29/29	---	2380	No	NA	NA	No	NUT
7782-49-2	Selenium	0.249	0.913	mg/kg	X7SS1830002	29/29	---	0.913	Yes	510 N	1700	No	BSL
7440-22-4	Silver	0.0593	0.238	mg/kg	X7SS1830002	29/29	---	0.238	Yes	510 N	1700	No	BSL
7440-23-5	Sodium	40.9	138	mg/kg	X7SS1800002, X7SS1830002	6/29	16.1 - 106	138	No	NA	NA	No	NUT
7440-28-0	**Thallium**	0.0808	0.525	mg/kg	X7SS1830002	28/29	0.128	0.525	No	**0.52 N**	24	**Yes**	ASL
7440-62-2	**Vanadium**	19.9	85.9	mg/kg	X7SS1830002	29/29	---	85.9	Yes	**7.8 N**	NA	**Yes**	ASL
7440-66-6	Zinc	30.9	148	mg/kg	X7SS0190002	29/29	---	148	Yes	2300 N	100000	No	BSL

TABLE 6-1

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR HUMAN HEALTH - DIRECT CONTACT WITH SURFACE SOIL
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Sample with Maximum Concentration	Frequency of Detection	Range of Non-Detects(2)	Concentration Used for Screening(3)	Site Above Background ?(4)	U. S. EPA Region 9 PRG (Residential)(5)	Potential ARAR/TBC(6)	COPC Flag	Rationale for Contaminant Deletion or Selection(7)
Field XRF (mg/kg)													
7439-92-1	**Lead**	18	741	mg/kg	X7SS0550002	151/189	---	741	Yes	**400**	**400**	**Yes**	ASL

Footnotes

1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - Background was not used to select COPCs (Section 6.2.2.1 of text).
5 - U.S. EPA Region 9 Preliminary Remediation Goal (PRG). The non-carcinogenic values (denoted with a "N" flag) are the PRG divided by 10 to correspond to a target hazard quotient of 0.1. Carcinogenic values represent an incremental cancer risk of 1.0E-06 (carcinogens denoted with a "C" flag) (U.S. EPA Region 9, 2004).
6 - Indiana Department of Environmental Management (IDEM), Risk Integrated System of Closure (RISC) residential closure levels for soil (January 2006).
7 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level. Chemicals selected as COPCs are indicated by shaded chemical names.
8 - The value for naphthalene was used as a surrogate for 2-methylnaphthalene.
9 - The value for acenaphthene was used as a surrogate for acenaphthylene.
10 - The value for pyrene is used as a surrogate for benzo(g,h,i)perylene and phenanthrene.
11 - The PRG for residential land use for total chromium is presented.
12 - Value is for hexavalent chromium.
13 - One-tenth of the non-carcinogenic PRG is less than the carcinogenic PRG; therefore, the one-tenth of the noncarcinogenic PRG is presented.

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirements/To Be Considered
C = Carcinogen
COPC = Chemical of potential concern
J = Estimated value
N = Non-carcinogen
NA = Not applicable/not available
PRG = Preliminary Remediation Goal

Rationale Codes:

For selection as a COPC:
ASL = Above Screening Level

For elimination as a COPC:
BSL = Below Screening Level
NTX = No Toxicity Data
NUT = Essential Nutrient

TABLE 6-2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN FOR HUMAN HEALTH - SURFACE SOIL -MIGRATION PATHWAYS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration[1]	Maximum Concentration[1]	Units	Sample with Maximum Concentration	Frequency of Detection	Range of Non-Detects[2]	Concentration Used for Screening[3]	Site above Background ?[4]	USEPA SSLs for Migration from Soil to Groundwater[5]	IDEM Criteria Migration from Soil to Groundwater[6]	USEPA SSLs for Migration from Soil to Air Residential[5]		USEPA SSLs for Migration from Soil to Air Construction[7]		COPC Flag	Rationale for Contaminant Deletion or Selection[8]
Semivolatile Organic Compounds																	
91-57-6	2-methylnaphthalene	3.9 J	40	ug/kg	X7SS1210002	3/11	1.6 - 1.8	40	NA	31000	700	NA		NA		No	BSL
83-32-9	Acenaphthene	4.9 J	550 J	ug/kg	X7SS1210002	4/11	1.1 - 1.3	550	NA	31000	130000	NA		NA		No	BSL
208-96-8	Acenaphthylene	27	27	ug/kg	X7SS1230002	1/11	0.63 - 0.75	27	NA	31000	18000	NA		NA		No	BSL
120-12-7	Anthracene	4.2 J	970	ug/kg	X7SS1210002	5/11	0.83 - 0.96	970	NA	650000	51000	NA		NA		No	BSL
56-55-3	**Benzo(a)anthracene**	10	6400	ug/kg	X7SS1210002	7/11	0.87 - 0.95	6400	NA	**160**	19000	NA		NA		**Yes**	ASL
50-32-8	**Benzo(a)pyrene**	14	8100 J	ug/kg	X7SS1210002	7/11	0.96 - 1	8100	NA	**410**	8200	NA		280000	C	**Yes**	ASL
205-99-2	**Benzo(b)fluoranthene**	20	12000 J	ug/kg	X7SS1210002	7/11	0.87 - 0.95	12000	NA	**490**	57000	NA		NA		**Yes**	ASL
191-24-2	Benzo(g,h,i)perylene	5.7 J	2900 J	ug/kg	X7SS1210002	7/11	0.96 - 1	2900	NA	230000	570000	NA		NA		No	BSL
207-08-9	**Benzo(k)fluoranthene**	6.4 J	4700 J	ug/kg	X7SS1210002	7/11	0.45 - 0.49	4700	NA	**490**	39000	NA		NA		**Yes**	ASL
218-01-9	**Chrysene**	13	7400	ug/kg	X7SS1210002	7/11	0.83 - 0.9	7400	NA	**160**	25000	NA		NA		**Yes**	ASL
53-70-3	Dibenzo(a,h)anthracene	18	970 J	ug/kg	X7SS1210002	4/11	1 - 1.2	970	NA	1500	18000	NA		NA		No	BSL
206-44-0	**Fluoranthene**	14	8700	ug/kg	X7SS1210002	7/11	0.83 - 0.9	8700	NA	**310**	880000	NA		NA		**Yes**	ASL
86-73-7	Fluorene	4.6 J	270	ug/kg	X7SS1210002	4/11	0.64 - 0.74	270	NA	41000	170000	NA		NA		No	BSL
193-39-5	**Indeno(1,2,3-cd)pyrene**	4.7 J	2900 J	ug/kg	X7SS1210002	7/11	1.2 - 1.3	2900	NA	**1400**	3100	NA		NA		**Yes**	ASL
85-01-8	Phenanthrene	21	4900	ug/kg	X7SS1210002	5/11	1 - 1.2	4900	NA	230000	13000	NA		NA		No	BSL
129-00-0	Pyrene	3.2 J	14000	ug/kg	X7SS1210002	8/11	1 - 1.1	14000	NA	230000	570000	NA		NA		No	BSL
Inorganics																	
7429-90-5	Aluminum	7910	19400	mg/kg	X7SS1270002,	29/29	---	19400	Yes	NA	NA	709000	N	NA		No	BSL
7440-36-0	**Antimony**	0.21 J	96.2 J	mg/kg	X7SS0390002	26/29	0.38 - 0.71	96.2	Yes	**0.27**	**5.4**	NA		NA		**Yes**	ASL
7440-38-2	**Arsenic**	3.86	17	mg/kg	X7SS1830002	29/29	---	17	Yes	**0.29**	**5.8**	769	C	58	C	**Yes**	ASL
7440-39-3	**Barium**	56.2	949	mg/kg	X7SS0040002	29/29	---	949	No	**82**	1600	70900	N	**170**	**N**	**Yes**	ASL
7440-41-7	Beryllium	0.407	1.35	mg/kg	X7SS0030002	29/29	---	1.35	Yes	3.2	63	1380	C	7.1	N	No	BSL
7440-43-9	**Cadmium**	0.387	2.21	mg/kg	X7SS1750002	29/29	---	2.21	No	**0.38**	7.5	1840	C	140	C	**Yes**	ASL
7440-70-2	Calcium	735	26700	mg/kg	X7SS0390002	29/29	---	26700	No	NA	NA	NA		NA		No	NUT
7440-47-3	**Chromium**	10.2	66.6	mg/kg	X7SS0030002	29/29	---	66.6	Yes	**2.1**	**38**	276	C	**21**	**C**	**Yes**	ASL
7440-48-4	**Cobalt**	6.79	22.8	mg/kg	X7SS1820002	29/29	---	22.8	No	**0.17**	NA	1180	C	NA		**Yes**	ASL
7440-50-8	Copper	6.34	427	mg/kg	X7SS0190002	29/29	---	427	Yes	560	920	NA		NA		No	BSL
7439-89-6	**Iron**	12200	90700	mg/kg	X7SS0030002	29/29	---	90700	Yes	NA	NA	NA		NA		**Yes**	ASL
7439-92-1	**Lead**	10.3	1160	mg/kg	X7SS0550002	29/29	---	1160	Yes	NA	**81**	NA		NA		**Yes**	ASL
7439-95-4	Magnesium	723	7000	mg/kg	X7SS0390002	29/29	---	7000	No	NA	NA	NA		NA		No	NUT
7439-96-5	**Manganese**	334	1370	mg/kg	X7SS0120002	29/29	---	1370	No	**110**	NA	70900	N	**18**	**N**	**Yes**	ASL
7440-02-0	**Nickel**	8.75	50.2	mg/kg	X7SS0030002	29/29	---	50.2	Yes	**14**	950	NA		NA		**Yes**	ASL
7440-09-7	Potassium	476	2380	mg/kg	X7SS1670002	29/29	---	2380	No	NA	NA	NA		NA		No	NUT
7782-49-2	**Selenium**	0.249	0.913	mg/kg	X7SS1830002	29/29	---	0.913	Yes	**0.26**	5.2	NA		NA		**Yes**	ASL
7440-22-4	Silver	0.0593	0.238	mg/kg	X7SS1830002	29/29	---	0.238	Yes	1.6	31	NA		NA		No	BSL
7440-23-5	Sodium	40.9	138	mg/kg	X7SS1800002, X7SS1830002	6/29	16.1 - 106	138	No	NA	NA	NA		NA		No	NUT
7440-28-0	**Thallium**	0.0808	0.525	mg/kg	X7SS1830002	28/29	0.128	0.525	No	**0.056**	2.8	NA		NA		**Yes**	ASL
7440-62-2	Vanadium	19.9	85.9	mg/kg	X7SS1830002	29/29	---	85.9	Yes	260	NA	NA		NA		No	BSL
7440-66-6	Zinc	30.9	148	mg/kg	X7SS0190002	29/29	---	148	Yes	680	14000	NA		NA		No	BSL
Field XRF (mg/kg)																	
7439-92-1	**Lead**	18	741	mg/kg	X7SS0550002	151/189	---	741	Yes	NA	**81**	NA		NA		**Yes**	ASL

Footnotes
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - Background was not used to select COPCs (Section 6.2.2.1 of text).
5 - U.S. EPA Soil Screening Levels (SSLs). U.S. EPA Internet Site at http://risk.lsd.ornl.gov/calc_start.htm (soil to air SSLs for non-carcinogens are divided by 10).
The migration to groundwater value represents a dilution attenuation factor (DAF) of 1.
6 - Indiana Department of Environmental Management (IDEM), Risk Integrated System of Closure (RISC) residential closure levels for soil (2006).
7 - U.S. EPA soil screening levels (SSLs) for the inhalation of volatiles and fugitive dusts for construction workers calculated based on methodology from
U.S. EPA's Soil Screening Guidance (1996 and 2002).
8 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level.
Chemicals selected as COPCs are indicated by shaded chemical names.

Definitions:
C = Carcinogen
COPC = Chemical of potential concern
J = Estimated value
N = Non-carcinogen
NA = Not applicable/not available
PRG = Preliminary Remediation Goal

Rationale Codes:
For selection as a COPC:
ASL = Above Screening Level

For elimination as a COPC:
BSL = Below Screening Level
NTX = No Toxicity Data
NUT = Essential Nutrient

TABLE 6-3

CHEMICALS RETAINED AS COPCS FOR HUMAN HEALTH
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical	Surface Soil		
	Direct Contact	Soil to Air	Soil to Groundwater
Semivolatile Organic Compounds			
Benzo(a)anthracene	X		X
Benzo(a)pyrene	X		X
Benzo(b)fluoranthene	X		X
Benzo(k)fluoranthene	X		X
Chrysene			X
Dibenzo(a,h)anthracene	X		X
Indeno(1,2,3-cd)pyrene	X		X
Inorganics			
Aluminum	X		
Antimony	X		X
Arsenic	X		X
Barium	X	X	X
Cadmium			X
Chromium		X	X
Cobalt			X
Copper	X		
Iron	X		
Lead	X		X
Manganese	X	X	X
Nickel			X
Selenium			X
Thallium	X		X
Vanadium	X		

X - Indicates that chemical was retained as a chemical of potential concern.

TABLE 6-4

HUMAN HEALTH RECEPTORS AND EXPOSURE ROUTES FOR QUANTITATIVE EVALUATION
UXO 7 – RFI REPORT
NSWC CRANE
CRANE, INDIANA

Receptor	Exposure Routes
Construction Workers (future land use)	• Soil dermal contact • Soil ingestion • Inhalation of air/dust/emissions
Maintenance Workers (current and future land use)	• Soil dermal contact • Soil ingestion • Inhalation of air/dust/emissions
Occupational Workers (current and future land use)	• Soil dermal contact • Soil ingestion • Inhalation of air/dust/emissions
Adolescent Trespassers (6 to 17 years) (current and future land use)	• Soil dermal contact • Soil ingestion • Inhalation of air/dust/emissions
Small Child (0 to 6 years) and Adult Recreational Users (future land use)	• Soil dermal contact • Soil ingestion • Inhalation of air/dust/emissions
On-Base Residents (Adult/Children) (future land use)	• Soil dermal contact • Soil ingestion • Inhalation of air/dust/emissions

TABLE 6-5

SUMMARY OF EXPOSURE INPUT PARAMETERS
REASONABLE MAXIMUM EXPOSURES
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Exposure Parameter	Construction Worker	Maintenance Worker	Occupational Worker	Adolescent Trespasser	Child Recreational User	Adult Recreational User	On-Site Child Resident	On-Site Adult Resident
All Exposures								
C_{soil} (mg/kg)	Maximum or 95% UCL(1)	Maximum or 95% UCL(1)	Maximum or 95% UCL(1)	Maximum or 95% UCL(1)	Maximum or 95% UCL(1)	Maximum or 95% UCL(1)	Maximum or 95% UCL(1)	Maximum or 95% UCL(1)
ED (years)	1(2)	25(3)	25(3)	11(4)	6(5)	24(5)	6(5)	24(5)
BW (kg)	70(5)	70(5)	70(5)	43(6)	15(5)	70(5)	15(5)	70(5)
AT_n (days)	365(6)	9,125(6)	9,125(6)	4,015(6)	2,190(6)	8,760(6)	2,190(6)	8,760(6)
AT_c (days)	25,550(6)	25,550(6)	25,550(6)	25,550(6)	25,550(6)	25,550(6)	25,550(6)	25,550(6)
Incidental Ingestion/Dermal Contact with Soil								
IR (mg/day)	330(7)	100(5)	100(5)	100(5)	200(5)	100(5)	200(5)	100(5)
EF-Soil (days/year)	150(8)	24(9)	250(5)	26(10)	52(11)	52(11)	350(5)	350(5)
FI (unitless)	1(5)	1(5)	1(5)	1(5)	0.5(2)	0.5(2)	1(5)	1(5)
SA (cm^2/day)	3,300(12)	3,300(12)	3,300(12)	3,280(13)	3,300(14)	9,070(15)	2,800(12)	5,700(12)
AF (mg/cm^2)	0.3(12)	0.2(12)	0.2(12)	0.2(12)	0.2(12)	0.07(12)	0.2(12)	0.07(12)
ABS (unitless)	chemical-specific(12)	chemical-specific(12)	chemical-specific(12)	chemical-specific(12)	chemical-specific(12)	chemical-specific(12)	chemical-specific(12)	chemical-specific(12)
CF (kg/mg)	1E-06	1E-06	1E-06	1E-06	1E-06	1E-06	1E-06	1E-06
Inhalation Fugitive Dust/Volatile Emissions from Surface Soil								
C_{air} (mg/m^3)	calculated(16)	NA	NA	NA	NA	NA	NA	NA
InhR (m^3/hour)	2.5(17)	NA	NA	NA	NA	NA	NA	NA
ET (hours/day)	8(18)	NA	NA	NA	NA	NA	NA	NA
PEF (m^3/kg)	1.5E+06(7)	NA	NA	NA	NA	NA	NA	NA

Notes:

A	Skin surface area available for contact	EF	Exposure frequency
ABS	Absorption factor	ET	Exposure time
AF	Soil-to-skin adherence factor	EV	Event frequency
AT_c	Averaging time for carcinogenic effects	FI	Fraction ingested from contaminated source
AT_n	Averaging time for non-carcinogenic effects	InhR	Inhalation rate
B	Bunge Model partitioning coefficient	IR	Ingestion rate (soil or groundwater)
BW	Body weight	K_p	Permeability coefficient from water through skin
CF	Conversion factor	SA	Skin surface area available for contact
CR	Contact rate	PEF	Particulate emission factor
C_{soil}	Exposure concentration for soil	τ	Lag time
C_{air}	Exposure concentration for air	t*	Time it takes to reach steady-state conditions
ED	Exposure duration	t_{event}	Duration of event
		UCL	Upper confidence limit on arithmetic mean

TABLE 6-5

SUMMARY OF EXPOSURE INPUT PARAMETERS
REASONABLE MAXIMUM EXPOSURES
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Exposure Parameter	Construction Worker	Maintenance Worker	Occupational Worker	Adolescent Trespasser	Child Recreational User	Adult Recreational User	On-Site Child Resident	On-Site Adult Resident

1 - U.S. EPA, 2002.
2 - Professional judgment.
3 - U.S. EPA, 1991.
4 - Adolescents ages 7 to 16 years old.
5 - U.S. EPA, 1993.
6 - U.S. EPA, 1989.
7 - U.S. EPA, 2002.
8 - Ground is assumed to be frozen or snow covered 22 weeks per year.
9 - Assume 2 days a month for reasonable maximum exposure and 1 day a month for central tendency exposure.
10 - Assume 1 day a week in warm weather months for resonable maximum exposure and every other week for central tendency exposure.
11 - Assume 2 days a week in warm weather months for reasonable maximum exposure and 1 day a week for central tendency exposure.
12 - U.S. EPA, 2004.
13 - Assume 25 percent of total body surface area is exposed, U.S. EPA, 1997.
14 - Assume 50 percent of total body surface area is exposed, U.S. EPA, 2004.
15 - Assume that head, arms, hands, lower legs, and feet are exposed, U.S. EPA, 1997.
16 - U.S. EPA, 1996.
17 - U.S. EPA, 1997.
18 - Assume an 8-hour work shift.

TABLE 6-6

SUMMARY OF EXPOSURE INPUT PARAMETERS
CENTRAL TENDENCY EXPOSURES
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA
PAGE 1 OF 2

Exposure Parameter	Construction Worker	Maintenance Worker	Occupational Worker	Adolescent Trespasser	Child Recreational User	Adult Recreational User	On-Site Child Resident	On-Site Adult Resident
All Exposures								
C_{soil} (mg/kg)	Maximum or 95% UCL[1]	Maximum or 95% UCL[1]	Maximum or 95% UCL[1]	Maximum or 95% UCL[1]	Maximum or 95% UCL[1]	Maximum or 95% UCL[1]	Maximum or 95% UCL[1]	Maximum or 95% UCL[1]
ED (years)	1[2]	9[3]	9[3]	11[4]	2[3]	7[3]	2[3]	7[3]
BW (kg)	70[3]	70[3]	70[3]	43[5]	15[3]	70[3]	15[3]	70[3]
AT_n (days)	365[5]	3,285[5]	3,285[5]	4,015[5]	730[5]	2,555[5]	730[5]	2,555[5]
AT_c (days)	25,550[5]	25,550[5]	25,550[5]	25,550[5]	25,550[5]	25,550[5]	25,550[5]	25,550[5]
Incidental Ingestion/Dermal Contact with Soil								
IR (mg/day)	165[6]	50[3]	50[3]	50[3]	100[3]	50[3]	100[3]	50[3]
EF-Soil (days/year)	150[7]	12[8]	219[3]	13[9]	26[10]	26[10]	234[3]	234[3]
FI (unitless)	1[3]	1[3]	1[3]	1[3]	0.5[2]	0.5[2]	1[3]	1[3]
SA (cm^2/day)	3,300[11]	3,300[11]	3,300[11]	3,100[12]	3,300[13]	9,070[14]	2,800[11]	5,700[11]
AF (mg/cm^2)	0.1[11]	0.02[11]	0.02[11]	0.04[11]	0.04[11]	0.01[11]	0.04[11]	0.01[11]
ABS (unitless)	chemical-specific[11]	chemical-specific[11]	chemical-specific[11]	chemical-specific[11]	chemical-specific[11]	chemical-specific[11]	chemical-specific[11]	chemical-specific[11]
CF (kg/mg)	1E-06	1E-06	1E-06	1E-06	1E-06	1E-06	1E-06	1E-06
Inhalation Fugitive Dust/Volatile Emissions from Surface Soil								
C_{air} (mg/m^3)	calculated[15]	NA	NA	NA	NA	NA	NA	NA
InhR (m^3/hour)	2.5[16]	NA	NA	NA	NA	NA	NA	NA
ET (hours/day)	8[17]	NA	NA	NA	NA	NA	NA	NA
PEF (m^3/kg)	1.5E+06[18]	NA	NA	NA	NA	NA	NA	NA

Notes:

A	Skin surface area available for contact	EF	Exposure frequency
ABS	Absorption factor	ET	Exposure time
AF	Soil-to-skin adherence factor	EV	Event frequency
AT_c	Averaging time for carcinogenic effects	FI	Fraction ingested from contaminated source
AT_n	Averaging time for non-carcinogenic effects	InhR	Inhalation rate
B	Bunge Model partitioning coefficient	IR	Ingestion rate (soil or groundwater)
BW	Body weight	K_p	Permeability coefficient from water through skin
CF	Conversion factor	NA	Not applicable
CR	Contact rate	SA	Skin surface area available for contact

SUMMARY OF EXPOSURE INPUT PARAMETERS
CENTRAL TENDENCY EXPOSURES
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Exposure Parameter	Construction Worker	Maintenance Worker	Occupational Worker	Adolescent Trespasser	Child Recreational User	Adult Recreational User	On-Site Child Resident	On-Site Adult Resident

C_{soil}	Exposure concentration for soil	PEF	Particulate emission factor
C_{air}	Exposure concentration for air	τ	Lag time
ED	Exposure duration	t*	Time it takes to reach steady-state conditions
		t_{event}	Duration of event
		UCL	Upper confidence limit on arithmetic mean

1 - U.S. EPA, 2002.
2 - Professional judgment.
3 - U.S. EPA, 1993.
4 - Adolescents ages 7 to 16 years.
5 - U.S. EPA, 1989.
6 - Central tendency exposure is assumed to be one-half the reasonable maximum expousre value.
7 - Ground is assumed to be frozen or snow covered 22 weeks per year.
8 - Assume 2 days a month for RME and 1 day a month for CTE.
9 - Assume 1 day a week in warm weather months for RME and every other week for CTE.
10 - Assume 2 days a week in warm weather months for RME and 1 day a week for CTE.
11 - U.S. EPA, 2004.
12 - Assume 25 percent of total body surface area is exposed (U.S. EPA, 1997).
13 - Assume 50 percent of total body surface area is exposed (U.S. EPA, 2004).
14 - Assume that head, arms, hands, lower legs, and feet are exposed (U.S. EPA, 1997).
15 - U.S. EPA, 1996.
16 - U.S. EPA, 1997.
17 - Assume an 8-hour work shift.
18 - U.S. EPA, 2002.

TABLE 6-7

NON-CANCER TOXICITY DATA - ORAL/DERMAL
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal[1]	Absorbed RfD for Dermal[2]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Semivolatile Organic Compounds										
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals										
Aluminum	Chronic	1.0E+00	mg/kg/day	1	1.0E+00	mg/kg/day	CNS	100	EPA 9	10/2004
Antimony	Chronic	4.0E-04	mg/kg/day	0.15	6.0E-05	mg/kg/day	Blood	1000/1	IRIS	5/20/2008
Arsenic	Chronic	3.0E-04	mg/kg/day	1	3.0E-04	mg/kg/day	Skin, CVS	3/1	IRIS	5/20/2008
Barium	Chronic	2.0E-01	mg/kg/day	0.07	1.4E-02	mg/kg/day	Kidney	300/1	IRIS	5/20/2008
Chromium (as Chromium VI)	Chronic	3.0E-03	mg/kg/day	0.025	7.5E-05	mg/kg/day	Fetotoxicity/GS/Bone	300/3	IRIS	5/20/2008
Copper	Chronic	4.0E-02	mg/kg/day	1	4.0E-02	mg/kg/day	GS	NA	HEAST	7/1997
Iron	Chronic	7.0E-01	mg/kg/day	1	7.0E-01	mg/kg/day	NA	1	NCEA	10/11/2007
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	Chronic	2.0E-02	mg/kg/day	0.04	8.0E-04	mg/kg/day	CNS	1/1	IRIS	5/20/2008
Thallium	Chronic	7.0E-05	mg/kg/day	1	7.0E-05	mg/kg/day	Liver	3000	EPA 3	10/11/2007
Vanadium	Chronic	1.0E-03	mg/kg/day	0.026	2.6E-05	mg/kg/day	Kidney	300	NCEA	10/11/2007

Notes:

1 - U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.

2 - Adjusted dermal RfD = Oral RfD x Oral Absorption Efficiency for Dermal.

Definitions:

CNS = Central Nervous system

CVS = Cardiovascular system

EPA 9 = U.S. EPA Region 9 Preliminary Remediation Goal Table, October 2004, Updated December, 2007.

GS = Gastrointestinal system

HEAST= Health Effects Assessment Summary Tables

IRIS = Integrated Risk Information system

NCEA = National Center for Environmental Assessment, value from U.S.EPA Region 3 RBC Table, October 11, 2007.

NA = Not applicable

TABLE 6-8

NON-CANCER TOXICITY DATA - INHALATION
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD(1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Semivolatile Organic Compounds									
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals									
Aluminum	Chronic	3.5E-03	mg/m^3	1.0E-03	(mg/kg/day)	CNS	300	NCEA	10/11/2007
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	Chronic	5.0E-04	mg/m^3	1.4E-04	(mg/kg/day)	Fetus	1000/1	HEAST	7/1997
Chromium (as Chromium VI)	Chronic	1.0E-04	mg/m^3	3.0E-05	(mg/kg/day)	Lungs	300/1	IRIS	5/20/2008
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	Chronic	5.0E-05	mg/m^3	1.4E-05	(mg/kg/day)	CNS	1000/1	IRIS	5/20/2008
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
1 - Extrapolated RfD = RfC *$20m^3$/day / 70 kg

Definitions:
CNS = Central Nervous system
CVS = Cardiovascular system
NCEA = National Center for Environmental Assessment, value from U.S.EPA Region 3 RBC Table, October 11, 2007.
GS = Gastrointestinal system
HEAST= Health Effects Assessment Summary Tables
IRIS = Integrated Risk Information System
NA = Not applicable

TABLE 6-9

CANCER TOXICITY DATA - ORAL/DERMAL
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal(1)	Absorbed Cancer Slope Factor for Dermal(2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Semivolatile Organic Compounds								
Benzo(a)anthracene	7.3E-01	$(mg/kg/day)^{-1}$	1	7.3E-01	$(mg/kg/day)^{-1}$	B2	EPA(1)	7/1993
Benzo(a)pyrene	7.3E+00	$(mg/kg/day)^{-1}$	1	7.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	5/20/2008
Benzo(b)fluoranthene	7.3E-01	$(mg/kg/day)^{-1}$	1	7.3E-01	$(mg/kg/day)^{-1}$	B2	EPA(1)	7/1993
Benzo(k)fluoranthene	7.3E-02	$(mg/kg/day)^{-1}$	1	7.3E-02	$(mg/kg/day)^{-1}$	B2	EPA(1)	7/1993
Chrysene	7.3E-03	$(mg/kg/day)^{-1}$	1	7.3E-03	$(mg/kg/day)^{-1}$	B2	EPA(1)	7/1993
Dibenzo(a,h)anthracene	7.3E+00	$(mg/kg/day)^{-1}$	1	7.3E+00	$(mg/kg/day)^{-1}$	B2	EPA(1)	7/1993
Indeno(1,2,3-cd)pyrene	7.3E-01	$(mg/kg/day)^{-1}$	1	7.3E-01	$(mg/kg/day)^{-1}$	B2	EPA(1)	7/1993
Metals								
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	1.5E+00	$(mg/kg/day)^{-1}$	1	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	5/20/2008
Barium	NA	NA	NA	NA	NA	NA	IRIS	5/20/2008
Chromium (as Chromium VI)	NA	NA	NA	NA	NA	D	IRIS	5/20/2008
Copper	NA	NA	NA	NA	NA	D	IRIS	5/20/2008
Iron	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	B2	IRIS	5/20/2008
Manganese	NA	NA	NA	NA	NA	D	IRIS	5/20/2008
Thallium	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

1 - U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.

2 - Adjusted cancer slope factor for dermal = Oral cancer slope factor / Oral Absorption Efficiency for Dermal.

IRIS = Integrated Risk Information System.

NA = Not available.

EPA(1) = U.S. EPA, Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons, July 1993, EPA/600/R-93/089.

EPA Group:

A - Human carcinogen.

B1 - Probable human carcinogen - indicates that limited human data are available.

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans .

C - Possible human carcinogen.

D - Not classifiable as a human carcinogen.

E - Evidence of noncarcinogenicity.

TABLE 6-10

CANCER TOXICITY DATA - INHALATION
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor (1)		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Semivolatile Organic Compounds							
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	8.9E-01	$(mg/m^3)^{-1}$	3.1E+00	$(mg/kg/day)^{-1}$	B2	NCEA	10/11/2007
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA
Metals							
Aluminum	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA
Arsenic	4.3E+00	$(mg/m^3)^{-1}$	1.5E+01	$(mg/kg/day)^{-1}$	A	IRIS	5/20/2008
Barium	NA	NA	NA	NA	D	IRIS	5/20/2008
Chromium	1.2E+01	$(mg/m^3)^{-1}$	4.2E+01	$(mg/kg/day)^{-1}$	A	IRIS	5/20/2008
Copper	NA	NA	NA	NA	D	IRIS	5/20/2008
Iron	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	B2	IRIS	5/20/2008
Manganese	NA	NA	NA	NA	D	IRIS	5/20/2008
Thallium	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA

Notes:
1 - Inhalation CSF = Unit Risk * 70 kg / $20m^3$/day.

Definitions:
IRIS = Integrated Risk Information System.
NA = Not available.
NCEA = National Center for Environmental Assessment, value from U.S. EPA Region 3 RBC Table, October 11, 2007.

EPA Group:
A - Human carcinogen.
B1 - Probable human carcinogen - indicates that limited human data are available.
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans .
C - Possible human carcinogen.
D - Not classifiable as a human carcinogen.
E - Evidence of noncarcinogenicity.

TABLE 6-11

SUMMARY OF CANCER RISKS AND HAZARD INDICES - REASONABLE MAXIMUM EXPOSURE (RME)
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 1E-4	Chemicals with Cancer Risks > 1E-5 and ≤ 1E-4	Chemicals with Cancer Risks > 1E-6 and ≤ 1E-5	Hazard Index (HI)	Chemicals with HI > 1
Construction Worker	Surface Soil	Ingestion	1.E-06	- -	- -	- -	0.5	- -
		Dermal Contact	3.E-07	- -	- -	- -	0.006	- -
		Inhalation	1.E-06	- -	- -	- -	5	Manganese
		Total	3.E-06	- -	- -	- -	6	Manganese
		Total Surface Soil	3.E-06				6	
Maintenance Worker	Surface Soil	Ingestion	1.E-06	- -	- -	- -	0.03	- -
		Dermal Contact	3.E-07	- -	- -	- -	0.0007	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	2.E-06	- -	- -	- -	0.03	- -
		Total Surface Soil	2.E-06				0.03	
Occupational Worker	Surface Soil	Ingestion	1.E-05	- -	- -	Arsenic, cPAHs	0.3	- -
		Dermal Contact	8.E-06	- -	- -	cPAHs	0.007	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	2.E-05	- -	cPAHs	Arsenic	0.3	- -
		Total Surface Soil	2.E-05				0.3	
Trespasser	Surface Soil	Ingestion	2.E-06	- -	- -	cPAHs	0.04	- -
		Dermal Contact	2.E-06	- -	- -	cPAHs	0.001	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	4.E-06	- -	- -	cPAHs	0.05	- -
		Total Surface Soil	4.E-06				0.05	
Child Recreational User	Surface Soil	Ingestion	1.E-05	- -	- -	cPAHs	0.3	- -
		Dermal Contact	9.E-06	- -	- -	cPAHs	0.007	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	2.E-05	- -	cPAHs	Arsenic	0.3	- -
		Total Surface Soil	2.E-05				0.3	

TABLE 6-11

SUMMARY OF CANCER RISKS AND HAZARD INDICES - REASONABLE MAXIMUM EXPOSURE (RME)
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 1E-4	Chemicals with Cancer Risks > 1E-5 and ≤ 1E-4	Chemicals with Cancer Risks > 1E-6 and ≤ 1E-5	Hazard Index (HI)	Chemicals with HI > 1
Adult Recreational User	Surface Soil	Ingestion	2.E-06	- -	- -	cPAHs	0.03	- -
		Dermal Contact	3.E-06	- -	- -	cPAHs	0.001	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	5.E-06	- -	- -	cPAHs	0.03	- -
		Total Surface Soil	5.E-06				0.03	- -

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 1E-4	Chemicals with Cancer Risks > 1E-5 and ≤ 1E-4	Chemicals with Cancer Risks > 1E-6 and ≤ 1E-5	Hazard Index (HI)	Chemicals with HI > 1
Total Recreational Risks	Surface Soil	Ingestion	1.E-05	- -	- -	Arsenic, cPAHs	NA	- -
		Dermal Contact	1.E-05	- -	- -	cPAHs	NA	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	3.E-05	- -	cPAHs	Arsenic	NA	- -
		Total Surface Soil	3.E-05				NA	

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 1E-4	Chemicals with Cancer Risks > 1E-5 and ≤ 1E-4	Chemicals with Cancer Risks > 1E-6 and ≤ 1E-5	Hazard Index (HI)	Chemicals with HI > 1
Future Child Resident	Surface Soil	Ingestion	2.E-04	- -	Arsenic, cPAHs	- -	3	- -
		Dermal Contact	5.E-05	- -	cPAHs	Arsenic	0.04	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	2.E-04	cPAHs	Arsenic	- -	3	- -
		Total Surface Soil	2.E-04				3	

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 1E-4	Chemicals with Cancer Risks > 1E-5 and ≤ 1E-4	Chemicals with Cancer Risks > 1E-6 and ≤ 1E-5	Hazard Index (HI)	Chemicals with HI > 1
Future Adult Resident	Surface Soil	Ingestion	3.E-05	- -	cPAHs	Arsneic	0.4	- -
		Dermal Contact	1.E-05	- -	- -	cPAHs	0.006	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	4.E-05	- -	cPAHs	Arsenic	0.4	- -
		Total Surface Soil	4.E-05				0.4	

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 1E-4	Chemicals with Cancer Risks > 1E-5 and ≤ 1E-4	Chemicals with Cancer Risks > 1E-6 and ≤ 1E-5	Hazard Index (HI)	Chemicals with HI > 1
Total Residential Risks	Surface Soil	Ingestion	2.E-04	cPAHs	Arsenic	- -	NA	- -
		Dermal Contact	7.E-05	- -	cPAHs	Arsenic	NA	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	3.E-04	cPAHs	Arsenic	- -	NA	- -
		Total Surface Soil	3.E-04				NA	

cPAHs = Carcinogenic PAHs

TABLE 6-12

SUMMARY OF CANCER RISKS AND HAZARD INDICES - CENTRAL TENDENCY EXPOSURE (CTE)
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 1E-4	Chemicals with Cancer Risks > 1E-5 and ≤ 1E-4	Chemicals with Cancer Risks > 1E-6 and ≤ 1E-5	Hazard Index (HI)	Chemicals with HI > 1
Construction Worker	Surface Soil	Ingestion	6.E-07	- -	- -	- -	0.3	- -
		Dermal Contact	1.E-07	- -	- -	- -	0.002	- -
		Inhalation	1.E-06	- -	- -	- -	5	Manganese
		Total	2.E-06	- -	- -	- -	6	Manganese
		Total Surface Soil	2.E-06				6	
Maintenance Worker	Surface Soil	Ingestion	1.E-07	- -	- -	- -	0.006	- -
		Dermal Contact	1.E-07	- -	- -	- -	0.00003	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	2.E-07	- -	- -	- -	0.006	- -
		Total Surface Soil	2.E-07				0.006	
Occupational Worker	Surface Soil	Ingestion	2.E-06	- -	- -	- -	0.1	- -
		Dermal Contact	3.E-07	- -	- -	- -	0.0006	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	3.E-06	- -	- -	- -	0.1	- -
		Total Surface Soil	3.E-06				0.1	
Trespasser	Surface Soil	Ingestion	3.E-07	- -	- -	- -	0.01	- -
		Dermal Contact	6.E-08	- -	- -	- -	0.0001	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	3.E-07	- -	- -	- -	0.01	- -
		Total Surface Soil	3.E-07				0.01	
Child Recreational User	Surface Soil	Ingestion	3.E-07	- -	- -	- -	0.06	- -
		Dermal Contact	7.E-08	- -	- -	- -	0.0007	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	3.E-07	- -	- -	- -	0.06	- -
		Total Surface Soil	3.E-07				0.06	
Adult Recreational User	Surface Soil	Ingestion	1.E-07	- -	- -	- -	0.007	- -
		Dermal Contact	3.E-08	- -	- -	- -	0.0001	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	1.E-07	- -	- -	- -	0.007	- -
		Total Surface Soil	1.E-07				0.007	- -

TABLE 6-12

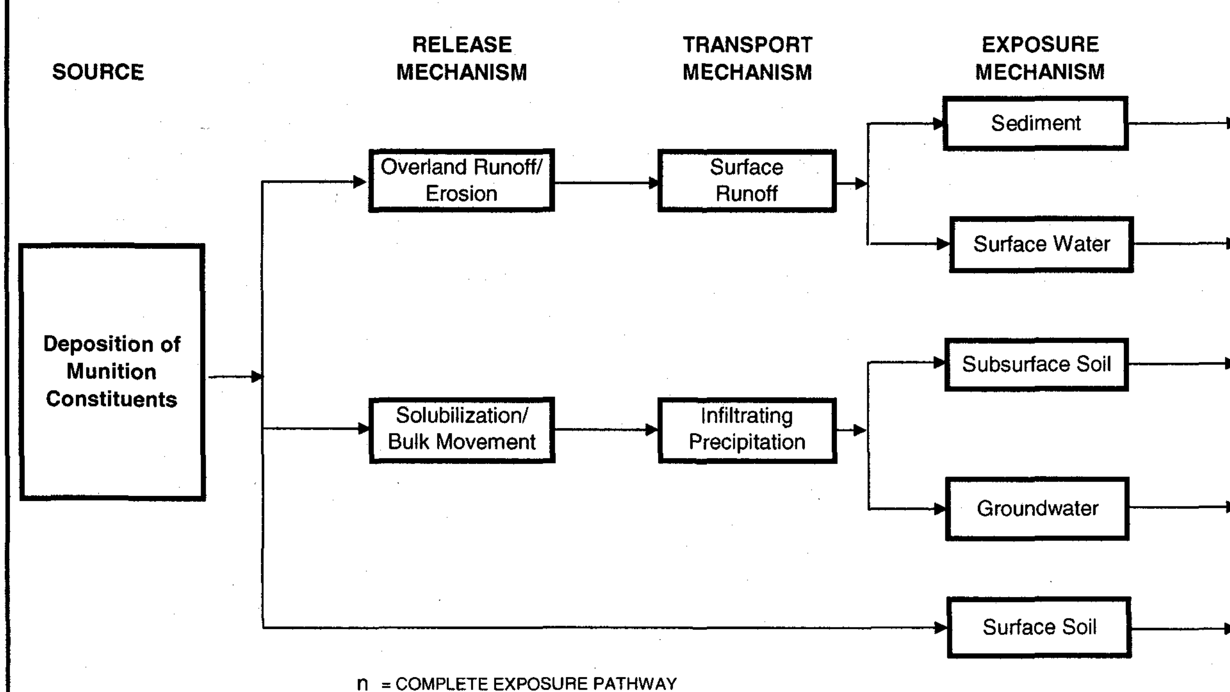
SUMMARY OF CANCER RISKS AND HAZARD INDICES - CENTRAL TENDENCY EXPOSURE (CTE)
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 1E-4	Chemicals with Cancer Risks > 1E-5 and ≤ 1E-4	Chemicals with Cancer Risks > 1E-6 and ≤ 1E-5	Hazard Index (HI)	Chemicals with HI > 1
Total Recreational Risks	Surface Soil	Ingestion	4.E-07	- -	- -	- -	NA	- -
		Dermal Contact	1.E-07	- -	- -	- -	NA	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	5.E-07	- -	- -	- -	NA	- -
		Total Surface Soil	5.E-07				NA	
Future Child Resident	Surface Soil	Ingestion	5.E-06	- -	- -	Arsenic, cPAHs	1	- -
		Dermal Contact	5.E-07	- -	- -	- -	0.005	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	5.E-06	- -	- -	Arsenic, cPAHs	1	- -
		Total Surface Soil	5.E-06				1	
Future Adult Resident	Surface Soil	Ingestion	2.E-06	- -	- -	- -	0.1	- -
		Dermal Contact	2.E-07	- -	- -	- -	0.0006	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	2.E-06	- -	- -	- -	0.1	- -
		Total Surface Soil	2.E-06				0.1	
Total Residential Risks	Surface Soil	Ingestion	7.E-06	- -	- -	Arsenic, cPAHs	NA	- -
		Dermal Contact	7.E-07	- -	- -	- -	NA	- -
		Inhalation	NA	- -	- -	- -	NA	- -
		Total	8.E-06	- -	- -	Arsenic, cPAHs	NA	- -
		Total Surface Soil	8.E-06				NA	

cPAHs = Carcinogenic PAHs

FIGURE 6-1

HUMAN HEALTH CONCEPTUAL SITE MODEL
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA



POTENTIAL RECEPTORS

EXPOSURE ROUTE	Construction Workers	Maintenance Workers	Occupational Workers	Recreational Users	Trespassers	Future Residents
Sediment						
Dermal Contact						
Ingestion						
Inhalation						
Surface Water						
Dermal Contact						
Incidental Ingestion						
Inhalation						
Fish Ingestion						
Subsurface Soil						
Dermal Contact						
Ingestion						
Inhalation						
Groundwater						
Dermal Contact						
Ingestion						
Inhalation (Showering)						
Inhalation (in a trench)						
Surface Soil						
Dermal Contact	n	n	n	n	n	n
Ingestion of soil	n	n	n	n	n	n
Inhalation	n	n	n	n	n	n

Blank space indicates incomplete exposure pathway or relatively insignificant, or not applicable potential exposure.

7.0 ECOLOGICAL RISK ASSESSMENT

The goal of this Screening-Level Ecological Risk Assessment (SERA) for UXO 7 was to evaluate the potential for adverse ecological impacts due to site-related contamination. This goal was accomplished by identifying COPCs detected at concentrations that exceed screening levels, identifying the locations of these exceedances, and concluding whether or not further investigation and/or remedial action at UXO 7 at NSWC Crane is warranted from an ecological perspective.

7.1 INTRODUCTION

The SERA methodology used at NSWC Crane is in accordance with the following guidance documents:

- Department of Navy Environmental Policy Memorandum 97 04: Use of Ecological Risk Assessments dated May 16, 1997.

- Navy Policy for Conducting Ecological Risk Assessments (ERAs) (Navy, 1999).

- Final Guidelines for Ecological Risk Assessment (U.S. EPA, 1998).

- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (U.S. EPA, 1997).

This SERA consists of Steps 1, 2, and 3a of the eight-step ecological risk evaluation process discussed in U.S. EPA guidance (1997 and 1998) and the Navy Policy for Conducting Ecological Risk Assessments (ERAs) (Navy, 1999). These eight steps consist of Steps 1 and 2, which constitute a SERA, followed by five additional steps, which constitute a Baseline Ecological Risk Assessment (BERA), and conclude with Step 8, a risk management evaluation. Step 3a is technically the first step of the BERA and consists of a refinement of the conservative exposure assumptions, but it is included in this SERA in accordance with Navy guidance. Steps 3b through 7 are conducted if additional evaluations or investigations are necessary. Aspects of Step 8, risk management, are addressed throughout the ERA process, in cooperation with Region 5 regulators.

A schematic diagram of the general risk assessment process is provided as Figure 7-1. In addition, Figure 7-2 is a flow chart that summarizes the SERA process as used to evaluate risks for ecological receptors exposed to chemicals in surface soil. This flow chart is discussed later in this SERA.

7.2 SCREENING-LEVEL PROBLEM FORMULATION

The screening-level problem formulation is the first step of the SERA and includes identification of potential receptor groups, COPCs, and the mechanisms for contaminant fate, transport, and toxicity. Determination of the complete exposure pathways that exist at a site is accomplished at this point to facilitate receptor selection. The problem formulation process enables the risk assessor to identify the ecological resources to be protected (known as assessment endpoints), the measurements that were used to evaluate risks to those resources (known as measures of effects) and the chemicals, geographic areas, and environmental media relevant to the risk assessment.

As part of receptor identification, site habitats and potential ecological receptors are described. These characteristics, as they apply to ecological risk, are described in the following subsections.

7.2.1 Environmental Setting

7.2.1.1 Basewide Environmental Setting

A biological characterization of NSWC Crane, including a list of plants and animals found at the facility, is presented in the Installation Assessment (IA) (Army, 1978) and the Initial Assessment Study (IAS) (NEESA, 1983) and is summarized in the Environmental Monitoring Reports (EMRs) (Halliburton NUS, 1992a and 1992b). A list of the species that may inhabit NSWC Crane and that are protected under the United States Endangered Species Act, Indiana Department of Natural Resources Heritage Data Center, or the United States Fish and Wildlife Service (USFWS) is summarized in the RCRA Facility Permit and below. The following paragraphs briefly summarize the environmental setting at the base.

Eighty percent of NSWC Crane's 63,000 acres is classified as Central Hardwoods Forest of the United States (NEESA, 1983). In addition, some former agricultural fields are in various stages of succession. Open spaces on dry upland sites contain almost pure stands of grasses with some clumps of woody plants such as persimmon, sassafras, and sumac. Wetter sites have river birch, willow, sycamore, and cottonwood. Hillside communities have mostly hickory, white and black oak, red maple, sugar maple, tulip poplar, ash, and beech (NEESA, 1983).

The great variety of habitats at NSWC Crane (i.e., many stages of forest succession, streams, ponds, Lake Greenwood, grassy open spaces) lead to great diversity of animal species (NEESA, 1983). These species include but are not limited to mammals such as white-tailed deer, beaver, coyote, hawks, red fox, rabbits, raccoons, and mice; birds such as ducks, geese, wild turkey, bobwhite quail, red-tailed hawks, and American robins; and various amphibians, reptiles, fish, and invertebrates.

Six main creeks receive drainage in five separate drainage basins at NSWC Crane: Furst Creek, Sulphur Creek, Little Sulphur Creek, Boggs Creek, Turkey Creek, and Seed Tick Creek. There are also many smaller streams, creeks, and drainage ditches located at the facility, along with several small man-made ponds and one large lake (Lake Greenwood). Lake Greenwood is the source of potable water for NSWC Crane. Surface water from the facility eventually discharges to the East Fork of the White River, which is located south of the facility.

Threatened and Endangered Species

The Endangered Species Management Plan for NSWC Crane (Comarco Systems, Inc., 2000) identified the federal and state threatened and endangered species and species of special concern potentially present at the facility. Information included in the Endangered Species Management Plan was obtained from studies and surveys conducted by the Navy and other agencies and groups such as universities and research institutions. A small subset of these studies include the inventory of neotropical migratory birds, mist net and radiotelemetry surveys for the Indiana Bat, bobcat trapping, rattlesnake survey, Purdue University wildlife studies, and several fish surveys, and bird counts. These studies and others that were used in compiling the list of endangered species present at NSWC Crane are described in more detail in the Endangered Species Management Plan (Comarco Systems, Inc., 2000) and below.

The Indiana Bat is the only federally threatened or endangered species documented to occur at NSWC Crane. The USFWS issued a notice in the Federal Register (72 FR 37346 et seq.) on July 9, 2007, that effective August 8, 2007, the American Bald Eagle would be removed from the federal List of Endangered and Threatened Wildlife and Plants. The American Bald Eagle will still be protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act (USFWS, 2007). The bald eagle is not likely to be present at UXO 7 due to a lack of vast expanses of open water (i.e., the preferred hunting habitat for the bald eagle). No mist nets were located at UXO 7 during the mist net and radiotelemetry surveys for the Indiana Bat; however, two mist net sites were located in the main stream tributary to Boggs Creek adjacent to SWMU 13, which is less than one mile northwest of UXO 7. No Indiana bats were captured at these two locations between May 18 and July 11, 1998. Therefore, although Indiana bats have been captured at NSWC Crane, their presence surrounding UXO 7 has not been documented.

In addition, a number of state endangered and federal and state species of concern have been listed for NSWC Crane (Comarco Systems, Inc., 2000). The state endangered species list includes two mammals (bobcat and Indiana bat), one reptile (timber rattlesnake), and several birds (bald eagle, osprey, loggerhead shrike, yellow-crowned night-heron, Virginia rail, king rail, and Henslow's sparrow).

Boggs Creek and Turkey Creek discharge off site to the East Fork of the White River. River otters, a state endangered species, are being reintroduced to Indiana. The otters are expanding from their original release sites into other watersheds including the East Fork of the White River (IDNR, 2004). Also, the East Fork of the White River is the site of an ongoing study of lake sturgeon populations, another state endangered species (IDNR, 2004). Finally, spotted darters, a state species of special concern, has been found in the East Fork of the White River (IDNR, 2000).

7.2.1.2 Site-Specific Environmental Setting

UXO 7 is located within the boundaries of the ORR, which occupies approximately 20 acres. The ORR is part of a larger unit designated as SWMU 7. UXO 7 is immediately west of NSWC Crane Highway 8 in the flat-lying floodplain of Turkey Creek. The site consists of a flat, grass-covered area bisected from north to south by an unnamed but maintained gravel road. The other areas used for rifle and pistol target practice are inactive. Munitions handled at UXO 7 consisted of small arms.

The vegetation at UXO 7 includes intermittently mowed grasslands, wooded slopes, and riparian wooded vegetation in the vicinity of the Turkey Creek drainage.

A large portion of UXO 7 drains directly into Turkey Creek. All water and sediment discharging from UXO 7 eventually enters Turkey Creek. An unnamed perennial stream flows from northwest to southeast through the northern end of SWMU 7 and drains into Turkey Creek. Another unnamed tributary flows from west to east through the southern end of UXO 7 and enters Turkey Creek. This tributary receives surface water runoff from the southern end of UXO 7. It also drains some of the ridgetop area occupied by the Demolition Range (DR) (SWMU 6). A small man-made sediment retention basin (Pond 3) has been constructed on this unnamed tributary west of UXO 7. To aid in the settling of solids from Pond 3, an additional impoundment (Pond 3A) was constructed in the southeastern corner of the ORR.

UXO 7 includes three distinct zones currently under investigation: the Northern Zone (500- and 400-yard firing positions and dirt mound), the Central Zone (300-, 200-, and 100-yard firing positions and former East and West Trap Ranges), and the Southern Zone (main targets and barricade, hillside impact area, and former South Pistol Range). All of these areas were used for small arms firing activities including rifle, pistol and trap shooting.

7.2.2 Contaminants, Ecotoxicity, and Fate and Transport

Based on historical site data, the following parameters are among the site-related chemical contaminants known to be present or potentially present in environmental media at UXO 7:

- SVOCs (PAHs) near the trap ranges only
- Inorganics

7.2.2.1 Physical and Chemical Characteristics

Physical and chemical characteristics of contaminants may affect their mobility, transport, and bioavailability in the environment. These characteristics include bioaccumulation factors (BAFs), K_{OC}s, and K_{OW}s. The physical and chemical characteristics of the chemical classes present or potentially present in UXO 7 media are presented in Appendix F.

7.2.3 Potential Exposure Pathways

The ORR at NSWC Crane in UXO 7 was apparently constructed and used since about 1940 and initially served as the Marine Rifle Range at the installation (USACE WES, June 1998). During the 1940s it was utilized as a practice rifle range for firing small caliber ammunition. The Navy has identified aerial photographs from the late 1940s and early 1950s that in addition to depicting discrete earthen berms on the ORR, clearly showed evidence of a semi-circular shaped trap range and an additional small pistol range within the limits of the ORR. An installation drawing dated October 13, 1947 confirmed the operation of a pistol and trap range during that operational period. Subsequent information indicated the presence of an east trap range and a west trap range, so named based on their position to the central road within the ORR. The pistol range was located in the extreme southeast corner of UXO 7.

Beginning in the 1950s, the ORR was used primarily for open burning or flashing of the explosive Yellow-D (ammonium picrate, 2,4,6-trinotrophenol ammonium salt) from bulk amounts and also in loaded projectiles which were managed in three burning pits. The explosive burning was initially conducted on bare ground prior to 1986, but was later performed in clay-lined steel pans at the location. The open burning of Yellow-D along with the flashing of scrap from the Demolition Range continues as a permitted operation.

Voluntary Interim Measures (VIM) were performed by the Navy in July 2003 at the ORR and approximately 25 tons of explosives-contaminated soil were excavated from the open burn area and disposed offsite in a special waste landfill. The excavation was backfilled with gravel in September 2003. The VIM Report and an After Action Report for the interim measure activity were included as Appendix I of the Phase III Soils Report RCRA Facility Investigation Solid Waste Management Unit 7 (Old Rifle Range), NSWC Crane Division, prepared by Tetra Tech in September 2005.

Information on deposition mechanisms is presented in Section 4.0 and the discussion on potential contaminant migration patterns and is included in Section 5.0. The Interim Measures Report for SWMU 7 – Old Rifle Range and Old Pistol Range Site, September 2007 (TtNUS, September 2007) prepared by Tetra Tech includes a brief list of previous investigations and studies completed by the U.S. Army Corps of Engineers and Tetra Tech specific to SWMU 7 and relevant to the general UXO 7 area. The potential sources of contamination in UXO 7 are presented in Section 6.3.1.1 of this RFI report. The contaminants from these sources may have migrated to soil, sediment, surface water, and/or groundwater via various transport pathways, (e.g., particulate emissions, runoff, infiltration).

7.2.3.1 Surface Soil

Several groups of terrestrial ecological receptors can be exposed to contaminants in surface soil. Invertebrates such as earthworms are exposed to contaminants as they move through the soil and ingest soil particles while searching for food. Plants are exposed to contaminants via direct contact as contaminants are absorbed through the roots, and contaminants are then translocated to different parts of the plants (e.g., leaves, seeds). These pathways are evaluated in the SERA.

Small mammals may be exposed to contaminants in soil via several exposure routes. They may be exposed by direct contact as they search for food or burrow into the soil. Exposure of terrestrial wildlife to contaminants in the soil via dermal contact is unlikely to represent a major exposure pathway because fur, feathers, and chitinous exoskeletons are expected to minimize transfer of contaminants across dermal tissue. Therefore, the dermal pathway was not evaluated in the SERA. Small mammals also may be exposed to contaminants in soil via incidental ingestion of soil and ingestion of plants and/or invertebrates that have accumulated contaminants from the soil. These pathways are evaluated in the SERA.

Larger predatory species such as the red fox and red-tailed hawk can be indirectly exposed to soil contaminants by ingesting small mammals that have accumulated contaminants from soil. UXO 7 is relatively small compared to home ranges of the above predatory species, and the chemicals detected at the site (PAHs and metals) do not magnify through the food chain, so these pathways were not evaluated in the SERA.

7.2.3.2 Groundwater

Ecological receptors are not directly exposed to contaminants in groundwater at the site. Exposure to groundwater discharging as a seep or directly to a surface water body represents a complete exposure pathway and is evaluated as part of the surface water pathway.

7.2.3.3 Surface Water/Sediment

As mentioned above, contaminated groundwater may discharge as a seep that flows into surface water or may discharge directly into a surface water body. Contaminants in soil may also enter the intermittent drainage channels at UXO 7 via overland flow.

Two small perennial streams occur at UXO 7, one to the north and one to the south. Both of these streams eventually enter Turkey Creek. Surface water and sediment samples were collected on two previous occasions (TtNUS, 1999, 2007a) from areas in Turkey Creek bordering UXO 7. During those investigations, COCs, including lead, at UXO 7 did not appear to be migrating off site to the sediments of Turkey Creek, and the conclusion was that no further investigation of sediments at UXO 7 was necessary. Therefore, risks to ecological receptors from concentrations of chemicals in surface water and sediment were not evaluated in the SERA because additional surface water and sediment samples were not collected as part of this RFI.

7.2.3.4 Air

Inhalation of particulates by mammals and birds is not considered a complete pathway at UXO 7 because there are no activities causing air contamination. Also, inhalation pathways are not typically evaluated in SERAs because of the uncertainty inherent in estimating exposure levels and toxicological effects. Therefore, the air inhalation pathway is not evaluated in the SERA.

7.2.4 Endpoints

7.2.4.1 Assessment Endpoints

Assessment endpoints are an explicit expression of the environmental value that is to be protected (U.S. EPA, 1997). The selection of these endpoints is based on the habitats present, migration pathways of probable contaminants, and relevant exposure routes for the receptors.

As discussed in 7.2.1.2, the habitat at UXO 7 consists of mostly grass with some wooded areas and some areas covered by roads, parking areas, and buildings. Based on the habitats at UXO 7 and the chemicals present at the site, the assessment endpoints include protection of the following groups of receptors from adverse effects of contaminants on their growth, survival, and reproduction:

- Terrestrial vegetation
- Soil invertebrates
- Herbivorous birds and mammals
- Soil invertebrate-eating birds and mammals
- Reptiles

The following paragraphs discuss the reasons that the above assessment endpoints were selected for evaluation in the SERA.

Terrestrial Vegetation: Terrestrial vegetation at UXO 7 consists of grasses, shrubs, and trees. They serve as a food source and provide shade and cover for many organisms, and they help to prevent soil erosion, among other important functions. They also can accumulate some contaminants that can then be transferred to the higher trophic-level organisms that consume plants.

Soil Invertebrates: Soil invertebrates are present in soil at UXO 7. They aid in the formation of soil and the redistribution and decomposition of organic matter in the soil, and they serve as a food source for higher trophic-level organisms. They also can accumulate bioaccumulative contaminants that can then be transferred to the higher trophic-level organisms that consume soil invertebrates.

Herbivorous Birds and Mammals: Herbivorous birds and mammals (i.e., animals that consume only plant tissue) forage in some portions of UXO 7. Their role in the community is essential because, without them, higher trophic levels could not exist (Smith, 1966). They may be exposed to and accumulate contaminants present in the plants they consume.

Soil Invertebrate-Eating Birds and Mammals: Soil invertebrate-eating birds and mammals are present throughout the base in different terrestrial habitats (e.g., forested, open field) and are present at UXO 7. These are considered first-level carnivores, and they serve as a food source for higher trophic-level carnivores. They may be exposed to and accumulate contaminants present in the food items they consume.

Reptiles: Reptiles can inhabit both aquatic environments and terrestrial habitats. Reptiles feed primarily on invertebrates, plants, fish, and/or small mammals. They are exposed to and can accumulate contaminants from the food items they consume.

Not all of the potential assessment endpoints listed above were evaluated in this SERA. As indicated in U.S. EPA guidance (1997), "it is not practical or possible to directly evaluate risks to all of the individual components of the ecosystem at a site. Instead, assessment endpoints focus the risk assessment on particular components of the ecosystem that could be adversely affected by contaminants from the site." Therefore, the SERA will focus on the endpoints that will tend to yield the highest risks, which should then account for endpoints that will have lower risks.

Omnivores were not selected as assessment endpoints because exposure to contaminants in plants is greatest for herbivores, and exposure to contaminants in animals is greatest for insectivores. Therefore, omnivores are protected by protecting herbivores and insectivores.

7.2.4.2 Measures of Effects

Measures of effects are estimates of measurable biological impacts (e.g., mortality, growth, and reproduction) that are used to evaluate the assessment endpoints. The following measures of effects were used to evaluate the assessment endpoints in the SERA:

- Soil screening values - Mortality, growth, and reproduction of plants and soil invertebrates were evaluated by comparing the measured concentrations of chemicals in surface soil to screening values designed to be protective of ecological receptors.

- Wildlife toxicity reference values (TRVs) - Mortality, reproductive, and/or developmental effects of birds and mammals were evaluated by comparing the estimated dose incurred (based on conservative and average assumptions) from ingestion of contaminants in surface soil, plants, and invertebrates to wildlife TRVs.

7.2.4.3 Selection of Receptor Species

Many receptors in the soil environments at UXO 7 are typically grouped into general categories such as invertebrates and vegetation. This is a reflection of the nature of the threshold values, effects values, or criteria typically used to characterize risk for such organisms. However, for vertebrate receptors, selection of a representative species is required so that risks to these upper-level species incurred by intake through eating and drinking can be estimated.

Ingestion is the primary route of exposure for most mammals and birds. The selection of species used to represent the receptor groups identified in Section 7.2.4.1 was based on considerations of their preferred habitat, body size, sensitivity to contaminants, home range, abundance, commercial or sport utilization, legal status, and functional role (e.g., predators). The availability of exposure parameters such as body mass, feeding rate, and drinking rate was also a factor in selecting surrogate species. The following surrogate species were used in the food-chain modeling conducted as part of this SERA:

- Herbivorous mammal - Meadow vole
- Herbivorous bird - Bobwhite quail
- Insectivorous mammal - Short-tailed shrew
- Insectivorous bird - American woodcock

Receptor profiles for each of the species above are presented in Appendix F.

7.2.4.4 Conceptual Site Model

A conceptual model in problem formulation is a written description and visual representation of predicted relationships between ecological entities and the stressors to which they may be exposed. The conceptual model consists of two primary components: predicted relationships among stressor, exposure, and assessment endpoint response and a diagram that illustrates the relationships (U.S. EPA, 1998).

The primary sources of known or potential contamination at UXO 7 were identified based on past operational practices and the physical characteristics of the site. The primary sources of contamination have been identified as small arms fire activities (pistol, rifle, and trap shooting)

The primary stressors to ecological receptors are contaminants in surface soil. The primary receptors for contaminants in surface soil are plants, invertebrates, amphibians, and reptiles, and secondary receptors are birds and mammals. Figure 7-3 represents the ecological CSM for UXO 7.

7.3 ECOLOGICAL EFFECTS EVALUATION/SELECTION OF CONTAMINANTS OF POTENTIAL CONCERN

7.3.1 Ecological Effects Evaluation

The preliminary ecological effects evaluation is an investigation of the relationship between the magnitude of exposure to a chemical and the nature and magnitude of adverse effects resulting from exposure. In addition to being a toxicological evaluation, it may also include descriptions of apparent effects seen during the site visit (e.g., stressed vegetation). Toxicity thresholds are usually expressed in units of concentration when the medium of concern is in intimate contact with the receptor, such as soil for soil invertebrates. For other receptors, such as terrestrial vertebrates, toxicity data are typically available as doses, with units equal to mass of contaminant per unit of body mass per unit of time (usually mg/kg-day).

As the first step in the ecological effects evaluation, COPCs were selected by comparing contaminant concentrations in surface soil to U.S. EPA Ecological Soil Screening Levels (Eco SSLs) (U.S. EPA, 2005 and supporting documents). These values were used in place of the Region 5 ecological screening levels (ESLs) for soil because they are based on more recent data. If an Eco SSL was not available, Region 5 ESLs (U.S. EPA, 2003) were used in COPC selection. The following are the rules used to select COPCs for UXO 7:

- A contaminant was retained as a COPC for risks to plants and invertebrates if the maximum detected concentration in surface soil exceeded the associated screening level. Contaminants with maximum detected concentration that exceeded their associated screening levels or are considered important bioaccumulative chemicals by U.S. EPA (2000) were retained as COPCs for wildlife. Contaminants retained as COPCs were further evaluated as part of Step 3a of the eight-step ERA process.

- Calcium, magnesium, potassium, and sodium were not retained as COPCs in any medium because of their relatively low toxicity to ecological receptors and their high natural variability in concentrations. These inorganics are considered essential nutrients.

An Ecological Effects Quotient (EEQ) approach was used to characterize the risk to ecological receptors. This approach characterizes potential effects by comparing exposure concentrations with effects data. The EEQs for terrestrial receptors were calculated as follows:

$$EEQ = \frac{C_{ss}}{SSSL}$$

where:

Css = contaminant concentration in surface soil (µg/kg or mg/kg)

SSSL = surface soil screening level (µg/kg or mg/kg)

An EEQ of greater than 1.0 was considered to indicate potential risk. Such values do not necessarily indicate that an effect will occur but only that a low (i.e., conservative) threshold has been exceeded.

7.3.2 Selection of Contaminants of Potential Concern in Surface Soil

As discussed in Section 2.0, 189 surface soil samples were collected at UXO 7. Of those samples, all were analyzed for lead by XRF, 29 were analyzed for TAL metals, and 11 were analyzed for PAHs. Thirty-four of the samples were collected in the Northern Zone, 105 were collected in the Central Zone, and 50 were collected in the Southern Zone. Figure 2-1 shows the surface soil sample locations included in the ecological COPC selection. These locations represent areas where ecological receptors could potentially be exposed to contaminants.

The QAPP Addendum (TtNUS, 2007a) indicated that the XRF lead data would be used in this SERA if the correlation between field and laboratory values was greater than 65 percent (TtNUS, 2007b). Correlation between the field XRF and laboratory data was 93 percent. A regression equation was developed from the log-transformed XRF and laboratory lead data. The XRF data were then converted to a laboratory equivalent value. After evaluating the converted results, a pattern of converted XRF data over predicting lead concentrations at low levels and under predicting concentrations at high levels was apparent. Over predicting at low levels would lend to conservative values for lead being used. Under predicting at higher levels was accounted for by using the laboratory values. Laboratory lead concentrations in general were elevated because sampling for laboratory analysis was biased towards samples where XRF lead concentrations were high. Therefore, when a laboratory concentration was available, it was used in place of a laboratory-equivalent XRF value. Table 7-1 provides a summary of the laboratory, raw XRF, and converted XRF data. Statistical comparisons are provided in Appendix D.

Tables 7-2, 7-3, and 7-4 are the ecological surface soil screening tables for the Northern, Central, and Southern Zones, respectively, and show the contaminants selected as COPCs for the respective sample groups. Chemicals selected as COPCs for plants, invertebrates, and wildlife are highlighted in Tables 7-2 through 7-4.

Eleven inorganics were retained in the Northern Zone (500- and 400-yard firing positions and dirt mound) as COPCs because maximum detected concentrations exceeded their respective screening levels.

Ten inorganics and eight PAHs were retained in the Central Zone (300-, 200-, and 400-yard firing positions and former East and West Trap Ranges) as COPCs because maximum detected concentrations exceeded their respective screening levels.

Thirteen inorganics were retained in the Southern Zone (main targets and barricade, hillside impact area, and former South Pistol Range) as COPCs because maximum detected concentrations exceeded their respective screening levels.

7.4 STEP 3A - REFINEMENT OF CONSERVATIVE EXPOSURE ASSUMPTIONS

Step 3a consists of refining the conservative exposure assumptions/concentrations used to evaluate potential risks to ecological receptors (i.e., plants, invertebrates, and wildlife receptors) and re-evaluating the analytical data using benchmarks that are more appropriate for the assessment endpoints. The objective of the Step 3a refinement was to better define those chemicals that contribute to potentially unacceptable levels of ecological risk, and to identify and eliminate from further consideration those COPCs that were retained because of the use of very conservative exposure scenarios. The Step 3a evaluation is designed to eliminate chemicals from further evaluation for certain groups of receptors. For example, a chemical might not be retained as a COPC in soil based on low risks to soil invertebrates but might be retained for evaluating risks to plants or wildlife. Chemicals are evaluated during Step 3a first for terrestrial plants and invertebrates (Section 7.4.1) and then for wildlife (Section 7.4.2).

Figure 7-2 is a flow chart that presents the SERA process used to evaluate risks to ecological receptors from chemicals in the surface soil. The following section describes the process for further evaluating chemicals initially selected as COPCs in surface soil.

Surface Soil

Chemicals initially selected as COPCs in surface soil were carried through three independent flow paths to further evaluate risks to: (1) plants, (2) invertebrates, and (3) wildlife (i.e., mammals and birds). This evaluation was conducted to determine whether there are potential risks to all three receptor groups (i.e., plants, invertebrates, and wildlife) or to only one or two of the receptor groups. This is important because if the site proceeds further to a BERA, the studies in the BERA should only focus on the receptors that are at potential risk. Because many of the initial screening levels were based on risks to mammals or birds, potential risks to plants and invertebrates cannot be determined using these values. Therefore, the first step in the Step 3a evaluation was to compare maximum chemical concentration in soil to Eco SSLs or "no-effects benchmarks" for plants and invertebrates. Although some of the alternate benchmarks may be based on thresholds such as Effects Concentrations for 20 percent of the test population (EC_{20}s), samples with chemical concentrations less than the no-effects benchmarks are not expected to have significant effects. Decisions made based on these comparisons are as follows:

- For inorganics, if the metal was statistically equal to or less than the basewide background concentration (see Appendix E), the metal was eliminated from consideration as a COPC.

- If the concentration was less than the no-effects benchmark, it was concluded that the chemical is not causing an unacceptable risk to that receptor group and the chemical was not evaluated further in Step 3a.

- If the chemical concentration was greater than the no-effects benchmark (or the chemical does not have a no-effects benchmark), the chemical was further evaluated in Step 3a to determine if the risks are great enough to warrant additional evaluations (i.e., proceed to a BERA, develop cleanup levels, proceed to a corrective measures study [CMS], etc.).

Concurrent with the evaluation of risks to plants and invertebrates, bioaccumulative chemicals and chemicals exceeding wildlife screening levels selected as COPCs were evaluated to determine if they pose unacceptable risks to wildlife. Even though conservative COPC screening levels may have been based on risks to wildlife, risks to wildlife were further evaluated in Step 3a to determine potential risks under a less conservative exposure scenario. The first step in the process was to determine whether the COPC is bioaccumulative. A chemical was considered to be bioaccumulative, and thus carried through the food-chain model, if it was included in the list of important bioaccumulative chemicals in U.S. EPA (2000). Non-bioaccumulative chemicals were not carried through the food-chain model (unless wildlife screening levels were exceeded), and it was concluded that they were not causing an unacceptable risk to wildlife. Decisions made based on the results of the food-chain model are as follows:

- If the EEQ is less than 1.0 using average contaminant concentrations and exposure factors and the no observable adverse effects level (NOAEL) as the TRV, it was concluded that the chemical is not causing an unacceptable risk to wildlife and the chemical was not evaluated further in Step 3a.

- If the EEQ is greater than 1.0 using average contaminant concentrations and exposure factors and the NOAEL as the TRV, the chemical was further evaluated in Step 3a to determine if the risks are great enough to warrant additional evaluations (i.e., proceed to a BERA, develop cleanup levels, proceed to a CMS, etc.).

For chemicals evaluated further in Step 3a, other Step 3a factors described below were used to determine if the risks were great enough to warrant additional evaluations (i.e., proceed to a BERA, develop cleanup levels, proceed to a CMS, etc.).

Other Step 3a Factors

For chemicals evaluated further in Step 3a, the following factors were evaluated, as appropriate, to determine if the risks are great enough to warrant additional evaluations (i.e., proceed to a BERA, develop cleanup levels, proceed to a CMS). All of these factors may not be discussed for each chemical and/or receptor group.

- Magnitude of criterion exceedance: Although the magnitude of risks may not relate directly to the magnitude of a criterion exceedance, the magnitude of the criterion exceedance may be one item used in a lines-of-evidence approach to determine the need for further site evaluation. The greater the criterion exceedance, the greater the probability and concern that an unacceptable risk exists.

- Frequency of chemical detection and spatial distribution: A chemical detected at a low frequency typically is of less concern than a chemical detected at higher frequency if toxicity and concentrations and spatial areas represented by the data are similar. All else being equal, chemicals detected frequently were given greater consideration than those detected relatively infrequently. In addition, the spatial distribution of a chemical may be evaluated to determine the area that a sample represents.

- Contaminant bioavailability: Many contaminants (especially inorganics) are present in the environment in forms that are typically not bioavailable, and limited bioavailability was considered when evaluating exposures of receptors to site contaminants. Contaminants with generally less bioavailability are considered to be less toxic than more bioavailable contaminants, all other factors being equal.

- Habitat: Although exceedances of criteria may occur, potential risks to ecological receptors may be minimal if there is little habitat for those receptors. Therefore, the extent of habitat was used qualitatively when considering additional evaluation. Areas with little habitat were less of a concern than areas with suitable habitat to support the receptors of interest.

- Alternate benchmarks: These benchmarks are used to further evaluate risks to specific groups of ecological receptors (e.g., plants, invertebrates) because, although ESLs are useful for initial screening, they are the most conservative values available for surface soil evaluation. For example, the screening levels for soil may be based on risks to small mammals. Therefore, an exceedance of that screening level does not necessarily indicate that potential risks to plants or invertebrates exist and so other more appropriate benchmarks were used to evaluate potential risks to those receptors. Use of these alternate benchmarks was case specific.

In addition to the general Step 3a factors above, other factors were evaluated in Step 3a for each receptor group. The following sections discuss the other factors that were used, including specific alternate benchmarks.

Terrestrial Plants and Invertebrates: The alternate benchmarks used to further evaluate risks to plants and invertebrates are listed below. The ecological endpoint for each benchmark used in the Step 3a refinement is provided in the discussion for each COC. For example, if a benchmark is based on a 25-percent reduction in growth to a lettuce plant, that information was presented.

- Eco SSL for plants (U.S. EPA, 2005 and supporting documents)
- Eco SSL for invertebrates (U.S. EPA, 2005 and supporting documents)
- Canadian SQGs (CCME, 2006 and supporting documents).
- Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision (Efroymson, et al., 1997).

Additional sources of toxicity data from the literature were used to evaluate potential risks to terrestrial vegetation and invertebrates from contaminants in surface soil not included in the above documents.

7.4.1 Terrestrial Plants and Invertebrates

Potential risks to terrestrial plants and invertebrates from exposure to chemicals initially selected as COPCs were further evaluated as discussed above. The following subsections discuss whether COPCs were retained for further evaluation for soil invertebrates and terrestrial vegetation in the Northern Zone (Section 7.4.1.1), Central Zone (Section 7.4.1.2), and Southern Zone (Section 7.4.1.3). COPCs based on risk to upper-level receptors via the food-chain are discussed in Section 7.4.2.

Risks to terrestrial plants and invertebrates resulting from exposure to COPCs in surface soil were evaluated using the methodologies described above (Section 7.4). Tables 7-5, 7-6, and 7-7 present summaries of some of the common alternate benchmarks available for COPCs in surface soil of the Northern, Central, and Southern Zones of UXO 7, respectively, along with summaries of the Step 3a evaluations. The toxicological basis for the alternate benchmarks are presented below.

7.4.1.1 Northern Zone

Cobalt, Manganese, and Selenium

Detected concentrations of cobalt, manganese, and selenium were determined to be not statistically different or appeared to be not different from the basewide background data set. Detailed statistical discussions are provided in Appendix F. Therefore, risks from these metals are not site related and they are eliminated as COPCs.

Antimony

Antimony was initially selected as a COPC because the maximum soil concentration of 96.2 mg/kg detected in the Northern Zone exceeded the Eco SSL for mammals of 0.27 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, antimony concentrations were compared to the Eco SSL for soil invertebrates of 78 mg/kg (U.S. EPA, Feb 2005). An Eco SSL was not available for plants to evaluate risks to these receptors, so the ORNL plant benchmark of 5 mg/kg (Efroymson et al., 1997) was used to further evaluate risks from chromium to plants.

The U.S. EPA Eco SSL for soil invertebrates (78 mg/kg) was developed after a review of over 239 technical studies. Of these, three studies were accepted for inclusion in the development of the Eco SSL. The Eco SSL is the geometric mean of the EC_{20} values (based on reproduction) reported for each of three test species evaluated under similar conditions of pH and percent organic matter (U.S. EPA, Feb 2005). The plant benchmark value of 5 mg/kg for antimony was based on one plant study that listed unspecified toxic effects on plants grown in surface soil with the addition of 5 ppm antimony in the form of a salt (Efroymson et al., 1997).

All detected concentrations except the maximum detected antimony concentration (96.2 mg/kg) in sample X7SS0390002 were less than the invertebrate Eco SSL. Because antimony at the site is related to bullets and was not disposed of as a salt, the antimony in the study used to develop the plant benchmark was much more available than antimony in soil at the site. Additionally, the Northern Zone is vegetated; therefore, risks to terrestrial plants and soil invertebrates from antimony are not expected, and antimony is eliminated as a COPC for these receptors.

Cadmium

Cadmium was initially selected as a COPC because the maximum soil concentration of 2.21 mg/kg detected in the Northern Zone exceeded the Eco SSL for mammals of 0.36 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, cadmium concentrations were compared to the following Eco SSLs for soil invertebrates and plants to evaluate risks to these receptors.

- U.S. EPA Eco SSL for soil invertebrates – 140 mg/kg (U.S. EPA, March 2005)
- U.S. EPA Eco SSL for plants – 32 mg/kg (U.S. EPA, March 2005)

The U.S. EPA Eco SSL for soil invertebrates of 140 mg/kg was developed after a review of over 239 technical studies. Of these, 10 studies were accepted for inclusion in the development of the Eco SSL. The Eco SSL is the geometric mean of the Maximum Acceptable Toxicant Concentration (MATC) or Effects Concentration for 10 percent of the test population (EC_{10}) values (based on growth, population, or reproduction) reported for each of three test species evaluated under six separate test conditions of pH (U.S. EPA, March 2005). The Eco SSL for plants (32 mg/kg) was developed after a review of over 716 technical studies. Of these, 14 studies were accepted for inclusion in the development of the Eco SSL. The Eco SSL is the geometric mean of the MATC (based on growth) reported for 14 test species under six separate test conditions of pH and percent organic matter (U.S. EPA, March 2005).

The maximum cadmium detection is less than the Eco SSLs for plants and soil invertebrates. Therefore, risks to plants and invertebrates from cadmium are expected to be acceptable, and cadmium is not retained as a COPC for risks to these receptors. However, because cadmium is a bioaccumulative chemical, risks to wildlife from cadmium are evaluated in Section 7.4.2 of this SERA.

Chromium

Chromium was initially selected as a COPC because the maximum soil concentration of 57 mg/kg exceeded the Eco SSL for mammals of 26 mg/kg. An Eco SSL was not available for plants or invertebrates, so the Canadian SQG of 64 mg/kg (EC, 1999a) was used to further evaluate risks from chromium to plants and soil invertebrates.

As presented in the supporting document for the Canadian SQG for chromium (EC, 1999a), the Canadian guideline for total chromium (64 mg/kg) is the geometric mean of the threshold effects concentration (TEC) of 78 mg/kg for risks to plants and invertebrates and the nutrient and energy cycling check value (NECC) of 52 mg/kg. The TEC is the sixth of 22 data points associated with the no observable effects and observable effects data for plants and invertebrates and corresponds to the average radish germination effects concentration 25 percent (EC_{25}). As detailed in the supporting document, no effects concentrations for earthworms (235 mg/kg to 900 mg/kg) were greater than no effects concentrations for plants (10 mg/kg to 230 mg/kg), indicating that invertebrates are less sensitive to total chromium than plants. Additionally, the Canadian SQG is based on total chromium (for which soil samples at this site were analyzed). Chromium toxicity is due primarily to hexavalent chromium. Other forms of chromium are much less toxic (Eisler, 2000). It is unlikely that chromium in UXO 7 soil is completely hexavalent chromium. Trivalent chromium is the predominant form of this metal in most soils and is not bioavailable (Eisler, 2000).

All detected concentrations were less than the Canadian SQG (64 mg/kg). Therefore, risks to plants and invertebrates from chromium are expected to be acceptable, and chromium is not retained as a COPC for risks to these receptors. However, because chromium is a bioaccumulative chemical, risks to wildlife from chromium are evaluated in Section 7.4.2 of this SERA.

<u>Copper</u>

Copper was initially selected as a COPC because the maximum soil concentration of 283 mg/kg detected in the Northern Zone exceeded the Eco SSL for mammals of 28 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, copper concentrations were compared to the following Eco SSLs for soil invertebrates and plants to evaluate risks to these receptors.

- U.S. EPA Eco SSL for soil invertebrates – 80 mg/kg (U.S. EPA, Feb 2007)
- U.S. EPA Eco SSL for plants – 70 mg/kg (U.S. EPA, Feb 2007)

The U.S. EPA Eco SSL for soil invertebrates of 80 mg/kg was developed after a review of over 173 technical studies. Of these, 10 studies were accepted for inclusion in the development of the Eco SSL. The Eco SSL is the geometric mean of the MATC or EC_{10} values (based on growth, population, or reproduction) reported for each of six test species evaluated under varying test conditions of pH and percent organic matter (U.S. EPA, Feb 2007). The Eco SSL for plants (70 mg/kg) was developed after a review of over 479 technical studies. Of these, six studies were accepted for inclusion in the development of the Eco SSL. The Eco SSL is the geometric mean of the MATC (based on growth) reported for four test species under varying test conditions of pH and percent organic matter (U.S. EPA, Feb 2007).

Although the average concentration is only slightly greater than the invertebrate and plant Eco SSL, numerous detections exceeded the Eco SSLs for plants and soil invertebrates in the Northern Zone of UXO 7. Additionally, the elevated copper detections correspond to samples with elevated lead concentrations. This would indicate that copper contamination is likely from the copper related to bullets. Therefore, copper is retained as a COPC for plants and invertebrates. Because copper is a bioaccumulative chemical, risks to wildlife from copper are evaluated in Section 7.4.2 of this SERA.

Lead

Lead was initially selected as a COPC because the maximum soil concentration of 1,160 mg/kg exceeded the U.S. EPA Eco SSL for birds of 11 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, lead concentrations were compared to the following Eco SSLs for soil invertebrates and plants to evaluate risks to these receptors:

- Eco SSL for plants – 120 mg/kg (U.S. EPA, March 2005)
- Eco SSL for soil invertebrates – 1,700 mg/kg (U.S. EPA, March 2005)

The Eco SSL for plants is the geometric mean of the MATC values for four test species under three different test conditions of varying pH and percent organic matter. The ecological endpoint for the derivation of the Eco SSL for plants was growth. The Eco SSL for soil invertebrates is the geometric mean of the MATC values for one test species (Folsomia candida) under three different test conditions (pH of 4.5 to 6.0) and is based on a reproductive endpoint.

The maximum lead concentration in the Northern Zone is less than the Eco SSLs for soil invertebrates. Therefore, risks to invertebrates from lead are expected to be acceptable and lead is not retained as a COPC for risks to this receptor group. Fourteen of the 34 sample locations had detected concentrations greater than the Eco SSL for plants. The Northern Zone is covered with vegetation, but the average detected concentration (182 mg/kg) is greater than the Eco SSL for plants. Therefore, lead is retained as a COPC for plants. Because lead is a bioaccumulative chemical, risks to wildlife from lead are evaluated in Section 7.4.2 of this SERA.

Thallium

Thallium was initially selected as a COPC because the maximum surface soil concentration of 0.53 mg/kg exceeded the ESL of 0.069 mg/kg. However, the ESL is based on risks to wildlife and not plants and invertebrates. Therefore, thallium concentrations were compared to the Canadian SQG of 1.4 mg/kg (EC, 1999) to evaluate risks to these receptors.

The SQG is based on reduced root and top growth of soybean, buckwheat, alfalfa, and rye grass. This value (1.4 mg/kg) was based on lowest observed effects concentration (LOEC) values and was derived using an uncertainty factor to account for the use of 40 percent effects concentrations. The maximum detected concentration of thallium in the Northern Zone at UXO 7 is significantly less than this benchmark. Therefore, risks to plants and invertebrates from thallium are expected to be acceptable and thallium is not retained as a COPC for risks to these receptors. However, because thallium exceeded the wildlife screening level, risks to wildlife from thallium are evaluated in Section 7.4.2 of this SERA.

Vanadium

Vanadium was initially selected as a COPC because the maximum soil concentration of 85.9 mg/kg exceeded the U.S. EPA Eco SSL for birds of 7.8 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, vanadium concentrations were compared to the Canadian SQG of 130 mg/kg (EC, 2001) following alternate benchmark to evaluate risks to these receptors.

The SQG is based on seedling emergence of lettuce (Lactuca sativa), which was selected in the SQG determination because it was the 25th percentile of 14 data points from studies of vanadium's effects on plants and soil invertebrates. All of the detected vanadium concentrations are significantly less than this benchmark. Therefore, risks to plants and invertebrates from vanadium are expected to be acceptable and vanadium is not retained as a COPC for risks to these receptors. However, because vanadium concentrations exceeded the Eco SSL for wildlife, risks to wildlife from vanadium are evaluated in Section 7.4.2 of this SERA.

Zinc

Zinc was initially selected as a COPC because the maximum soil concentration of 118 mg/kg exceeded the U.S. EPA Eco SSL for birds of 46 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, zinc concentrations were compared to the following Eco SSLs for soil invertebrates and plants to evaluate risks to these receptors:

- Eco SSL for plants – 160 mg/kg (U.S. EPA, June 2007)
- Eco SSL for soil invertebrates – 120 mg/kg (U.S. EPA, June 2007)

The Eco SSL for plants is the geometric mean of the MATC values for three test species under conditions of varying pH and percent organic matter. The ecological endpoint for the derivation of the Eco SSL for plants was growth. The Eco SSL for soil invertebrates is the geometric mean of the MATC and 10 percent effects concentration values for three species under conditions of varying pH and percent organic matter and is based on population and reproductive endpoints.

None of the detected concentrations of zinc exceeded the Eco SSLs for plants or soil invertebrates. Therefore, risks to plants and invertebrates from zinc are expected to be acceptable and zinc is not retained as a COPC for risks to these receptors. Because zinc is a bioaccumulative chemical, risks to wildlife from zinc are evaluated in Section 7.4.2 of this SERA.

7.4.1.2 Central Zone

PAHs

Eight high molecular weight (HMW) PAHs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and pyrene] were initially selected as COPCs because their maximum soil concentrations exceeded the U.S. EPA Eco SSL for mammals of 1,100 µg/kg (U.S. EPA, 2007). Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, HMW PAH concentrations were compared to the Eco SSL for soil invertebrates (18,000 µg/kg; U.S. EPA, June 2007). All of the maximum detected concentrations of HMW PAHs are less than the Eco SSL for soil invertebrates. An Eco SSL was not able to be derived for plants, so PAH concentrations were compared to the plant value in Appendix III of the Canadian SQG for benzo(a)pyrene (4,400,000 µg/kg; EC, 1999c).

The U.S. EPA Eco SSL for HMW PAHs of 18,000 µg/kg for soil invertebrates was developed after a review of over 94 technical studies. Of these, six studies were accepted for inclusion in the development of the Eco SSL based on a ranking that followed U.S. EPA study acceptance criteria. The Eco SSL is the geometric mean of the MATC or EC_{10} values (based on growth or reproduction) reported for each of four test species under varying conditions of pH and percent organic matter (U.S. EPA, 2007). In Appendix III of the Canadian SQG document for benzo(a)pyrene (EC, 1999c), a no observed effects concentration (NOEC) of 4,400 mg/kg was the lowest reported NOEC value for plants and was based on seedling emergence after 3 days of exposure. By using this NOEC for benzo(a)pyrene as a surrogate for HMW PAHs, it does not appear that PAHs in the UXO 7 soil are likely to impact plants because all detected concentration are significantly less than this benchmark. Therefore, risks to plants and invertebrates from HMW PAHs initially selected as COPCs are expected to be acceptable, and HMW PAHs are not retained as COPCs for risks to these receptors. Because PAHs are considered bioaccumulative chemicals, risks to wildlife from PAHs exceeding the mammal Eco SSL are evaluated in Section 7.4.2 of this SERA.

Cobalt, Selenium, and Thallium

Detected concentrations of cobalt, selenium, and thallium were determined to be not statistically different from the basewide background data set. Detailed statistical discussions are provided in Appendix F. Therefore, these risks from these metals are not site related and they are eliminated as COPCs.

Antimony

Antimony was initially selected as a COPC because the maximum soil concentration of 0.93 mg/kg detected in the Central Zone exceeded the Eco SSL for mammals of 0.27 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, antimony concentrations were compared to the Eco SSL for soil invertebrates of 78 mg/kg (U.S. EPA, Feb 2005). An Eco SSL was not available for plants to evaluate risks to these receptors, so the ORNL plant benchmark of 5 mg/kg (Efroymson et al., 1997) was used to further evaluate risks from antimony to plants.

The maximum detected antimony concentration (0.93 mg/kg) is significantly less than both of these benchmarks. Therefore, risks to terrestrial plants and soil invertebrates from antimony are not expected, and antimony is eliminated as a COPC for these receptors.

Barium

Barium was initially selected as a COPC because the maximum soil concentration of 627 mg/kg detected in Central Zone surface soil exceeded the Eco SSL for soil invertebrates of 330 mg/kg (U.S. EPA, February 2005). An Eco SSL was not available for plants to evaluate risks to these receptors, so the ORNL plant benchmark of 500 mg/kg (Efroymson et al., 1997) was used to further evaluate risks from barium to plants.

The U.S. EPA Eco SSL of 330 mg/kg for soil invertebrates was developed after a review of over 152 technical studies. Of these, three studies were accepted for inclusion in the development of the Eco SSL based on a ranking that followed U.S. EPA study acceptance criteria. The Eco SSL is the geometric mean of the EC_{20} values (based on reproduction) reported for each of three test species under three separate test conditions of pH (U.S. EPA, 2005). The ORNL plant benchmark of 500 mg/kg is based on a study that found a 38 percent reduction in shoot growth of barley 14 days after the addition of 500 mg/kg barium, which was the lowest concentration tested (Efroymson et al., 1997).

The maximum concentrations of barium in the Central Zone exceeded the Eco SSL for soil invertebrates (330 mg/kg) and the plant benchmark from Efroymson et al. (1997) (500 mg/kg); however, only the maximum sample exceeded these alternate benchmarks. Furthermore, the average barium concentration in the Central Zone was 312 mg/kg, which is less than the invertebrate Eco SSL and the plant benchmark. Therefore, although potential risks from barium are possible at the location of the maximum detection in the Central Zone, the overall risks to plants and invertebrates across the zone are expected to be acceptable and barium is not retained as a COPC for risks to these receptors.

Cadmium

Cadmium was initially selected as a COPC because the maximum soil concentration of 1.43 mg/kg detected in the Central Zone exceeded the Eco SSL for mammals of 0.36 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, cadmium concentrations were compared to the following Eco SSLs for soil invertebrates and plants to evaluate risks to these receptors:

- U.S. EPA Eco SSL for soil invertebrates – 140 mg/kg (U.S. EPA, Mar 2005)
- U.S. EPA Eco SSL for plants – 32 mg/kg (U.S. EPA, Mar 2005)

The maximum cadmium detection is less than the Eco SSLs for plants and soil invertebrates. Therefore, risks to plants and invertebrates from cadmium are expected to be acceptable and cadmium is not retained as a COPC for risks to these receptors. However, because cadmium is a bioaccumulative chemical, risks to wildlife from cadmium are evaluated in Section 7.4.2 of this SERA.

Lead

Lead was initially selected as a COPC because the maximum soil concentration of 99.4 mg/kg exceeded the U.S. EPA Eco SSL for birds of 11 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, lead concentrations were compared to the following Eco SSLs for soil invertebrates and plants to evaluate risks to these receptors:

- Eco SSL for plants – 120 mg/kg (U.S. EPA, March 2005)
- Eco SSL for soil invertebrates – 1,700 mg/kg (U.S. EPA, March 2005)

The maximum lead concentration in the Central Zone is less than the Eco SSLs for plants and soil invertebrates. Therefore, risks to plants and invertebrates from lead are expected to be acceptable and lead is not retained as a COPC for risks to these receptors. However, because lead is a bioaccumulative chemical, risks to wildlife from lead are evaluated in Section 7.4.2 of this SERA.

Manganese

Manganese was initially selected as a COPC because the maximum soil concentration of 770 mg/kg exceeded the U.S. EPA Eco SSL for plants of 220 mg/kg. To evaluate the risk to soil invertebrates, manganese concentrations were compared to the Eco SSL for soil invertebrates of 450 mg/kg (U.S. EPA, April 2007).

The maximum and average manganese concentrations in the Central Zone are greater than the Eco SSLs for plants and soil invertebrates. However, the detected concentrations of manganese are less than the 95th percentile for background concentrations in the Eastern U.S. (Figure 2.1, U.S. EPA, March 2005). Additionally, the site is heavily vegetated. Therefore, risks to plants and invertebrates from manganese are likely not site related and manganese is not retained as a COPC for risks to these receptors. Because manganese concentrations are less than the Eco SSLs for birds and mammals, 4,300 mg/kg and 4,000 mg/kg, respectively, and manganese is not considered an important bioaccumulative chemical (U.S. EPA, 2000), food-chain modeling for manganese was not conducted.

Vanadium

Vanadium was initially selected as a COPC because the maximum soil concentration of 38.1 mg/kg exceeded the U.S. EPA Eco SSL for birds of 7.8 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, vanadium concentrations were compared to the Canadian SQG of 130 mg/kg (EC, 2001) to evaluate risks to these receptors.

All of the detected vanadium concentrations are significantly less than this benchmark. Therefore, risks to plants and invertebrates from vanadium are expected to be acceptable and vanadium is not retained as a COPC for risks to these receptors. However, because vanadium concentrations exceeded the Eco SSL for wildlife, risks to wildlife from vanadium are evaluated in Section 7.4.2 of this SERA.

Zinc

Zinc was initially selected as a COPC because the maximum soil concentration of 64.4 mg/kg exceeded the U.S. EPA Eco SSL for birds of 46 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, zinc concentrations were compared to the following Eco SSLs for soil invertebrates and plants to evaluate risks to these receptors:

- Eco SSL for plants – 160 mg/kg (U.S. EPA, June 2007)
- Eco SSL for soil invertebrates – 120 mg/kg (U.S. EPA, June 2007)

None of the detected concentrations of zinc exceeded the Eco SSL for plants or soil invertebrates. Therefore, risks to plants and invertebrates from zinc are expected to be acceptable and zinc is not retained as a COPC for risks to these receptors. Because zinc is a bioaccumulative chemical, risks to wildlife from zinc are evaluated in Section 7.4.2 of this SERA.

7.4.1.3 Southern Zone

Cobalt, Manganese, and Thallium

Detected concentrations of cobalt, manganese, and thallium were determined to be not statistically different from the basewide background data set. Detailed statistical discussions are provided in Appendix F. Therefore, the risks from these metals are not site related, and they are eliminated as COPCs.

Antimony

Antimony was initially selected as a COPC because the maximum soil concentration of 11.1 mg/kg detected in the Southern Zone exceeded the Eco SSL for mammals of 0.27 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, antimony concentrations were compared to the Eco SSL for soil invertebrates of 78 mg/kg (U.S. EPA, Feb 2005). An Eco SSL was not available for plants to evaluate risks to these receptors, so the ORNL plant benchmark of 5 mg/kg (Efroymson et al., 1997) was used to further evaluate risks from antimony to plants.

The maximum detected antimony concentration (11.1 mg/kg) is less than the Eco SSL for invertebrates but greater than the plant benchmark. Because antimony at the site is related to bullets and was not disposed of as a salt, the antimony in the study used to develop the plant benchmark is much more available than antimony in soil at the site. Furthermore, the average antimony concentration at the Southern Zone is 3.8 mg/kg, which is less than the plant benchmark. Therefore, risks to terrestrial plants and soil invertebrates from antimony are not expected, and antimony is eliminated as a COPC for these receptors.

Barium

Barium was initially selected as a COPC because the maximum soil concentration of 949 mg/kg detected in Southern Zone surface soil exceeded the Eco SSL for soil invertebrates of 330 mg/kg (U.S. EPA, 2005). An Eco SSL was not available for plants to evaluate risks to these receptors, so the ORNL plant benchmark of 500 mg/kg (Efroymson et al., 1997) was used to further evaluate risks from barium to plants.

The maximum concentrations of barium at the Southern Zone exceeded the Eco SSL for soil invertebrates (330 mg/kg) and the plant benchmark from Efroymson et al. (1997) (500 mg/kg); however, only two samples exceeded these alternate benchmarks, X7SS0030002 and X7SS0040002. Furthermore, the average barium concentration in the Southern Zone was 325 mg/kg. Therefore, although potential risks from barium are possible at two locations in the Southern Zone, the overall risks to plants and invertebrates across the zone are expected to be acceptable and barium is not retained as a COPC for risks to these receptors.

Cadmium

Cadmium was initially selected as a COPC because the maximum soil concentration of 1.79 mg/kg detected in the Southern Zone exceeded the Eco SSL for mammals of 0.36 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, cadmium concentrations were compared to the following Eco SSLs for soil invertebrates and plants to evaluate risks to these receptors:

- Eco SSL for soil invertebrates – 140 mg/kg (U.S. EPA, Mar 2005)

- Eco SSL for plants – 32 mg/kg (U.S. EPA, Mar 2005)

The maximum cadmium detection is less than the Eco SSLs for plants and soil invertebrates. Therefore, risks to plants and invertebrates from cadmium are expected to be acceptable and cadmium is not retained as a COPC for risks to these receptors. However, because cadmium is a bioaccumulative chemical, risks to wildlife from cadmium are evaluated in Section 7.4.2 of this SERA.

Chromium

Chromium was initially selected as a COPC because the maximum soil concentration of 66.6 mg/kg exceeded the Eco SSL for mammals of 26 mg/kg. An Eco SSL was not available for plants and invertebrates, so the Canadian SQG of 64 mg/kg (EC, 1999a) was used to further evaluate risks from chromium to plants and soil invertebrates:

The maximum detected concentration in the Southern Zone (66.6 mg/kg) at X7SS0030002 was the only detected concentration that exceeded the Canadian SQG (64 mg/kg). All other detections were significantly less than this alternate benchmark. Furthermore, the maximum detected concentration only slightly exceeded the Canadian SQG. Therefore, risks to plants and invertebrates from chromium are expected to be acceptable and chromium is not retained as a COPC for risks to these receptors. However, because chromium is a bioaccumulative chemical, risks to wildlife from chromium are evaluated in Section 7.4.2 of this SERA.

Copper

Copper was initially selected as a COPC because the maximum soil concentration of 427 mg/kg detected in the Southern Zone exceeded the Eco SSL for mammals of 28 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, copper concentrations were compared to the following Eco SSLs for soil invertebrates and plants to evaluate risks to these receptors:

- U.S. EPA Eco SSL for soil invertebrates – 80 mg/kg (U.S. EPA, Feb 2007)
- U.S. EPA Eco SSL for plants – 70 mg/kg (U.S. EPA, Feb 2007)

The maximum detected concentration (427 mg/kg) at X7SS0190002 was the only detected concentration in the Southern Zone that exceeded the Eco SSLs for plants and soil invertebrates. All other detections were significantly less than these Eco SSLs. The average copper concentration in the Southern Zone is lower than the invertebrate Eco SSL and only slightly greater than the plant Eco SSL. The maximum copper detection corresponds to the sample with the maximum lead and zinc concentrations and is in the hillside impact area. Because copper contamination is likely related to bullets, copper concentrations would likely correlate with lead concentrations. The maximum copper detection is bounded directly to the east and west by samples X7SS0180002 and X7SS0200002. These samples were not analyzed for copper; however, they have relatively low lead concentrations at 108 mg/kg and 29 mg/kg, respectively. Therefore, it is likely that the maximum copper detection is bounded by concentrations that are much lower than the maximum detection. For these reasons, copper is eliminated as a COPC for plants and invertebrates in the hillside impact area. Because copper is a bioaccumulative chemical, risks to wildlife from copper are evaluated in Section 7.4.2 of this SERA.

Lead

Lead was initially selected as a COPC because the maximum soil concentration of 537 mg/kg exceeded the U.S. EPA Eco SSL for birds of 11 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, lead concentrations were compared to the following Eco SSLs for soil invertebrates and plants to evaluate risks to these receptors:

- Eco SSL for plants – 120 mg/kg (U.S. EPA, March 2005)
- Eco SSL for soil invertebrates – 1,700 mg/kg (U.S. EPA, March 2005)

The maximum lead concentration in the Southern Zone is less than the Eco SSLs for soil invertebrates. Eight of the 50 sample locations had detected concentrations greater than the Eco SSL for plants. However, the Southern Zone is covered with vegetation, and the average lead concentration (73 mg/kg) is significantly less than the Eco SSL for plants. The maximum detection is also bounded directly to the east and west by samples with concentrations less than the Eco SSL for plants (X7SS0180002 and X7SS0200002). Therefore, risks to plants and invertebrates from lead are expected to be acceptable and lead is not retained as a COPC for risks to these receptors. However, because lead is a bioaccumulative chemical, risks to wildlife from lead are evaluated in Section 7.4.2 of this SERA.

Nickel

Nickel was initially selected as a COPC because the maximum soil concentration of 50.2 mg/kg exceeded the U.S. EPA Eco SSL for plants of 38 mg/kg (U.S. EPA, March 2007). None of the detected concentrations of nickel were greater than the Eco SSL for soil invertebrates (280 mg/kg) (U.S. EPA, March 2007).

The Eco SSL for plants is the geometric mean of the MATC values for six test species under different test conditions of varying pH and percent organic matter. The ecological endpoint for the derivation of the Eco SSL for plants was growth and reproduction. The Eco SSL for soil invertebrates is the geometric mean of the MATC values for five test species under different test conditions of varying pH and percent organic matter and is based on reproductive endpoints.

Only the maximum detected concentration (50.2 mg/kg) at X7SS0030002 exceeded the plant Eco SSL for nickel. This area is covered with vegetation, and the sample is bounded to the west by two samples (X7SS0020002 and X7SS0040002) with concentrations significantly less than the plant Eco SSL (28.7 mg/kg and 16.8 mg/kg, respectively). Therefore, risks to plants and invertebrates from nickel are expected to be acceptable and nickel is not retained as a COPC for risks to these receptors. However, because nickel is a bioaccumulative chemical, risks to wildlife from lead are evaluated in Section 7.4.2 of this SERA.

Selenium

Selenium was initially selected as a COPC because the maximum soil concentration of 0.81 mg/kg exceeded the U.S. EPA Eco SSL for plants of 0.52 mg/kg (U.S. EPA, July 2007). None of the detected concentrations of selenium were greater than the Eco SSL for invertebrates (4.1 mg/kg) (U.S. EPA, July 2007).

The Eco SSL for plants is the geometric mean of the MATC and EC_{20} values for six test species under different test conditions of varying pH and percent organic matter. The ecological endpoint for the derivation of the Eco SSL for plants was growth. The Eco SSL for soil invertebrates is the geometric mean of the EC_{20} values for three test species and is based on reproductive endpoints.

Several of the detected concentrations of selenium were greater than the plant Eco SSL. The average concentration in the Southern Zone (0.63 mg/kg) was also greater than the plant Eco SSL (0.52 mg/kg). However, these concentrations are only slightly greater than the Eco SSL. The maximum EEQ is 1.6, and the average EEQ is 1.2. Additionally, most of the site is vegetated. The selenium present in surface soil at UXO 7 does not appear to be the result of site activities. Furthermore, the maximum detected selenium concentration is less than the 95th percentile of the Eastern regional background range, and the average concentration is less than the 75th percentile (U.S. EPA, July 2007). The average selenium concentration is only slightly greater than the average basewide background concentration of 0.48 mg/kg. Therefore, risks to plants and invertebrates from selenium are expected to be acceptable and selenium is not retained as a COPC for risks to these receptors. Because selenium is a bioaccumulative chemical, risks to wildlife from selenium are evaluated in Section 7.4.2 of this SERA.

Vanadium

Vanadium was initially selected as a COPC because the maximum soil concentration of 46.3 mg/kg exceeded the U.S. EPA Eco SSL for birds of 7.8 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, vanadium concentrations were compared to the Canadian SQG of 130 mg/kg (EC, 2001) to evaluate risks to these receptors.

All of the detected vanadium concentrations in the Southern Zone are significantly less than this benchmark. Therefore, risks to plants and invertebrates from vanadium are expected to be acceptable and vanadium is not retained as a COPC for risks to these receptors. However, because vanadium concentrations exceeded the Eco SSL for wildlife, risks to wildlife from vanadium are evaluated in Section 7.4.2 of this SERA.

Zinc

Zinc was initially selected as a COPC because the maximum soil concentration of 148 mg/kg exceeded the U.S. EPA Eco SSL for birds of 46 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, zinc concentrations were compared to the following Eco SSLs for soil invertebrates and plants to evaluate risks to these receptors:

- Eco SSL for plants – 160 mg/kg (U.S. EPA, June 2007)
- Eco SSL for soil invertebrates – 120 mg/kg (U.S. EPA, June 2007)

None of the detected concentrations of zinc in the Southern Zone exceeded the Eco SSL for plants (160 mg/kg). Only the maximum detection (148 mg/kg) of zinc in sample X7SS0190002 exceeded the Eco SSL for soil invertebrates (120 mg/kg). This concentration only slightly exceeds the Eco SSL for invertebrates. The average zinc concentration in the Southern Zone of UXO 7 is 89.3 mg/kg, which is significantly less than the Eco SSL for soil invertebrates. Therefore, risks to plants and invertebrates from zinc are expected to be acceptable and zinc is not retained as a COPC for risks to these receptors. Because zinc is a bioaccumulative chemical, risks to wildlife from zinc are evaluated in Section 7.4.2.

7.4.2 Food-Chain Modeling

The above-mentioned alternate benchmark values are not designed to evaluate risks to terrestrial wildlife via ingestion of surface soil. Therefore, a terrestrial intake model was used to estimate exposure of terrestrial receptors to COPCs. As presented in Tables 7-2 through 7-4, food-chain modeling was conducted for chemicals considered to be bioaccumulative (i.e., included in the list of important bioaccumulative chemicals in U.S. EPA (2000)) and with concentrations that exceeded the wildlife Eco SSLs or Region 5 ESLs, which take into account risks to wildlife.

7.4.2.1 Food-Chain Modeling Methodology

Risk to terrestrial receptors as a result of exposure to COPCs in surface soil was determined by estimating the total chronic daily intake (CDI) (see below) and comparing the CDI to the TRV (for each individual receptor) representing acceptable daily doses in mg/kg-day. The TRVs were developed from NOAELs and lowest observable adverse effect levels (LOAELs) obtained from wildlife studies, when available. The majority of the TRVs came from the U.S. EPA Eco SSL documents (U.S. EPA, 2005 and supporting documents) or ORNL Toxicological Benchmarks for Wildlife: 1996 Revision (Sample et al., 1996).

Appendix F presents the supporting documentation for the food-chain models and TRVs. Table F.1 presents the TRVs. Table F.2 presents the sources of the TRVs. References of the TRVs are presented in Appendix F. If a subchronic study was used to develop the TRV, the final value was multiplied by a factor of 0.1 to account for uncertainty between subchronic and chronic effects. If a LOAEL study was used to develop the NOAEL TRV, the LOAEL was multiplied by a factor of 0.1 to obtain the NOAEL.

The chemical-specific Eco SSL documents provide NOAELs and LOAELs from many studies, but TRVs were only calculated for NOAELs in those documents because Eco SSLs are meant to be conservative screening levels. Because risks based on both NOAELs and LOAELs are presented in this SERA, the geometric mean of growth and reproduction LOAELs from the chemical-specific Eco SSL documents were used as the LOAEL TRVs.

COPC intake for wildlife exposed to the COPCs in surface soil was estimated as daily doses in mg/kg-day using exposure equations. The contaminant concentrations in surface soil were used to calculate CDI doses. The following equations present the CDI equations used in calculating a total daily dose for the surrogate species selected for modeling:

$$\text{Dose, surface soil (mg/kg - day)} = \frac{(\text{Cs} * \text{SI})}{\text{BW}}$$

$$\text{Dose, food (mg/kg - day)} = \frac{(\text{FC} * \text{FI})}{\text{BW}}$$

$$\text{Total CDI (mg/kg - day)} = [\text{Dose (surface soil)} + \text{Dose (food)} * \text{H}]$$

Where:	FI	= food ingestion rate (kg/day)
	FC	= food concentration (mg/kg)
	BW	= body weight (kg)
	SI	= incidental soil ingestion rate (kg/day)
	Cs	= contaminant concentration in surface soil (mg/kg)
	H	= home range/contaminated area (assume = 1 for maximum exposure)

For organic constituents in surface soil, the contaminant concentration of prey items for the insectivorous and herbivorous species (e.g., earthworms, vegetation) was calculated using the following equation:

$$\text{FC} = \text{SC} * \text{BAF}$$

Where:	FC	= contaminant concentration in food (mg/kg)
	SC	= contaminant concentration in surface soil (mg/kg)
	BAF	= soil-to-plant or invertebrate bioaccumulation factor (unitless)

Chemical concentrations in food items for soil invertivorous and herbivorous receptors were calculated using soil-to-invertebrate or soil-to-plant BAFs and regression equations from the Eco SSL Guidance Document (U.S. EPA, April 2007) or BAFs from published sources.

Tables F.3 and F.4 (derivation of earthworm BAFs) in Appendix F present chemical-specific BAFs and other BAF data used in this SERA. A default value of 1.0 was used for the BAF if chemical-specific data were not available in the above sources.

The lower bound of the threshold effects is based on consistently conservative assumptions and NOAEL toxicity values (U.S. EPA, 1997b). This bound presents the greatest potential risks. The upper bound is based on observed impacts or predictions that ecological effects could occur and is developed using assumptions consistent with those used in the lower bound and LOAEL toxicity values (U.S. EPA, 1997b). This bound presents the average potential risk. These conservative and less conservative exposure scenarios were calculated to provide the overall range of potential risks to ecological receptors.

The exposure assumptions (e.g., ingestion rates and body weight) were obtained from the Wildlife Exposure Factors Handbook (U.S. EPA, 1993). Studies conducted in Indiana or surrounding states were used, when available, to estimate the exposure factors. If only one value was available for a given exposure parameter, the value was used regardless of where the study was conducted. The exposure parameters from U.S. EPA (1993) are wet-weight values; however, the BAFs presented in the above sources estimate the tissue concentrations in dry weight. Therefore, the exposure parameters from U.S. EPA (1993) were converted to dry-weight values for the food-chain model calculations. Table 7-8 presents the exposure parameters used in the SERA, and TableFG.5 in Appendix F presents the values used to calculate the exposure parameters and how they were calculated for use in the food-chain modeling.

An EEQ approach was used to characterize risk to terrestrial receptors. This approach characterizes the potential effects by comparing exposure concentrations to effects data. An EEQ greater than 1.0 is considered indicative of a potential risk. The EEQ is not an expression of probability, and the meaning of values greater than 1.0 must be interpreted in light of attendant uncertainties in risk management.

The EEQs for the terrestrial wildlife model was calculated as follows:

$$EEQ = \frac{\text{Total CDI}}{\text{TRV}}$$

Where:	EEQ	= ecological effects quotient (unitless)
	Total CDI	= total daily intake dose (mg/kg-day)
	TRV	= toxicity reference value (NOAEL or LOAEL) (mg/kg-day)

7.4.2.2 Results and Discussion

Appendix F presents the calculations of the food-chain modeling. Three sets of food-chain models were conducted for the herbivorous and vermivorous receptors, one for the Northern Zone, one for the Central Zone, and one for the Southern Zone.

Similar to the surface soil screening for plants and soil invertebrates, an evaluation using the maximum chemical concentrations was first conducted for all chemicals retained as COPCs for wildlife.

Tables 7-9 and 7-10 present a summary of the food-chain model results under the conservative and average exposure scenarios, respectively, for the herbivorous and vermivorous receptor species for the Northern Zone. Tables 7-11 and 7-12 present a summary of the food-chain model results under the conservative and average exposure scenarios, respectively, for the herbivorous and vermivorous receptor species for the Central Zone. Tables 7-13 and 7-14 present a summary of the food-chain model results under the conservative and average exposure scenarios, respectively, for the herbivorous and vermivorous receptor species for the Southern Zone.

Separate discussions are provided below for evaluations of potential risk to herbivorous and vermivorous receptors for surface soil in the three zones. Tables 7-15 through 7-17 present a summary of the Step 3a evaluation for terrestrial wildlife for the Northern Zone, Central Zone, and Southern Zone, respectively.

Northern Zone

For herbivorous receptors under the conservative food-chain scenario, NOAEL EEQs were greater than 1.0 for at least one receptor for four metals. Under the less conservative food-chain scenario, the NOAEL EEQ was greater than 1.0 for thallium for the vole (2.84). Typically, antimony and thallium are not considered important bioaccumulative chemicals (U.S. EPA, 2000). Additionally, the TRV for thallium is based on a single study using a rat that was given concentrations of thallium sulfate orally in water. This form of thallium is more bioavailable than the form of thallium in soil at UXO 7. Furthermore, a plant BAF was not available for thallium, so a default value of 1.0 was used to estimate chemical concentrations in plants for the herbivorous receptor food-chain models. This leads to an overestimation of the dose ingested in food items for the vole and quail. For these reasons and because of the low EEQ for the vole, thallium is not retained as a COPC for herbivorous receptors.

For vermivorous receptors under the conservative food-chain scenario, NOAEL EEQs were greater than 1.0 for at least one receptor for eight metals. Additionally, LOAEL EEQs were greater than 1.0 for at least one receptor for five metals. Under the less conservative food-chain scenario, NOAEL EEQs were greater than 1.0 for antimony, cadmium, and thallium for the shrew, copper and vanadium for the woodcock, and lead for the shrew and woodcock. None of the LOAEL EEQs were greater than 1.0.

The NOAEL EEQs for cadmium (1.08), lead (1.15) and thallium (2.84) for the shrew, and vanadium (1.84) and copper (1.55) for the woodcock are relatively low in magnitude compared to 1.0. Therefore, food-chain related effects to invertivorous receptors from these metals are expected to be low and are expected to be acceptable. The NOAEL EEQ for antimony is much greater than 1.0, but the LOAEL EEQ for antimony is significantly less than 1.0 (0.42). As stated above, antimony is not considered bioaccumulative and an earthworm BAF was not available. Therefore, a default value of 1.0 was used to estimate chemical concentrations in earthworms for the vermivorous receptor food-chain models. This leads to an overestimation of the dose ingested in food items for the shrew and woodcock because the actual accumulation of antimony in earthworms is likely to be much lower. This is because antimony is not a bioaccumulative metal and the form of the antimony at the site (from bullets) will be especially unavailable. Therefore, impacts to wildlife receptors from antimony are not expected to be significant. The NOAEL EEQ for lead for the woodcock (5.34) is greater than 1.0. Although it is unlikely that the form of lead (from bullets) will be very bioavailable, there is the potential for lead at the site to impact birds. Therefore, risks to the woodcock are expected, and lead is retained as a COPC in surface soil of the Northern Zone of UXO 7 for this receptor.

Central Zone

For herbivorous receptors under the conservative food-chain scenario, NOAEL EEQs were greater than 1.0 for the vole for pyrene and antimony. Under the less conservative food-chain scenario, none of the NOAEL EEQs were greater than 1.0 for herbivorous receptors.

For vermivorous receptors under the conservative food-chain scenario, NOAEL EEQs were greater than 1.0 for at least one receptor for eight PAHs and four metals. Under the less conservative food-chain scenario, NOAEL EEQs were greater than 1.0 for cadmium (1.11) for the shrew and vanadium (1.24) for the woodcock. The magnitudes of these EEQs are relatively low compared to 1.0, and none of the LOAEL EEQs are greater than 1.0. Therefore, food-chain related effects to these receptors from these metals are expected to be low and are expected to be acceptable.

Southern Zone

For herbivorous receptors under the conservative food-chain scenario, only the NOAEL EEQ for lead was greater than 1.0 for the quail. Under the less conservative food-chain scenario, the NOAEL EEQ for the quail for lead is less than 1.0.

For vermivorous receptors under the conservative food-chain scenario, NOAEL EEQs were greater than 1.0 at least one receptor for eight metals. Additionally, LOAEL EEQs were greater than 1.0 for at least one receptor for three metals. Under the less conservative food-chain scenario, NOAEL EEQs were greater than 1.0 for antimony, cadmium, and nickel for the shrew and copper, lead, and vanadium for the woodcock.

The NOAEL EEQs for cadmium (1.13), copper (1.58), and nickel (1.65) for the shrew and vanadium (1.33) and lead (2.48) for the woodcock are relatively low in magnitude compared to 1.0. Therefore, food-chain related effects to invertivorous receptors from these metals are expected to be low and are expected to be acceptable. The NOAEL EEQ for antimony (7.15) for the shrew is much greater than 1.0, but the LOAEL EEQ for antimony is significantly less than 1.0 (0.14). As stated above, antimony is not considered bioaccumulative and an earthworm BAF was not available. Therefore, a default value of 1.0 was used to estimate chemical concentrations in earthworms for the vermivorous receptor food-chain models. This leads to an overestimation of the dose ingested in food items for the shrew and woodcock because the actual accumulation of antimony in earthworms is likely to be much lower. This is because antimony is not a bioaccumulative metal and the form of the antimony at the site (from bullets) will be especially unavailable. Therefore, impacts to wildlife receptors from antimony are not expected to be significant.

7.5 ECOLOGICAL RISK UNCERTAINTY ANALYSIS

This section discusses some of the uncertainties associated with the UXO 7 SERA.

7.5.1 Measurement and Assessment Endpoints

Measurement endpoints were used to evaluate the assessment endpoints selected for the SERA. For the SERA, the measures of effects were not the same as the assessment endpoints. Measures were used to predict effects to the assessment endpoints by selecting surrogate species to be evaluated. For example, a decrease in reproduction of a shrew was used to assess a decrease in reproduction of the small mammal population. However, predicting a decrease in reproduction of a shrew may either underprotect or overprotect the small mammal population based on differences in ingestion rates, toxicity, food preferences, home ranges, etc. between different species.

Risks to reptiles were not quantitatively evaluated because exposure factors are not established for most species and because toxicity data are very limited (see below for a discussion of potential risks to the timber rattlesnake). As discussed in Section 7.2.1.1, several endangered and threatened species or species of special concern are present at NSWC Crane and potentially may inhabit UXO 7. Risks to these species were not specifically calculated, so the uncertainties of not calculating risks to these species are presented here. Unacceptable risks to the bobcat, bald eagle, Northern harrier, and osprey are not expected because habitat is not available. The bobcat has a significantly larger home range. The bald eagle and osprey require open water habitat, which is not available at UXO 7. The Northern harrier prefers wetlands habitat, which is not available at UXO 7. However, there is uncertainty with this conclusion because risks were not quantitatively evaluated.

Loggerhead shrikes and the sedge wren consume mostly aboveground insects such as caterpillars, beetles, spiders, and flies, as opposed to the worms that are consumed by the American woodcock in the food-chain model. Because worms are in direct contact with soil, it is expected that they would have greater levels of contaminants at UXO 7 than aboveground insects; therefore, risks to the woodcock from consuming worms are expected to be greater than risks to the loggerhead shrike and sedge wren from consuming aboveground insects. By protecting the woodcock, these other insectivorous birds will also be protected. The American bittern is a marshland bird that feeds on fish, frogs, eels, insects, and water snakes. The tributaries at UXO 7 do not provide preferred habitat (marshes) for the bittern, so it is not likely that it will be present in this area. As mentioned in Section 7.2.1.1, the presence of the Indiana bat has not been documented at or surrounding UXO 7.

Finally, there are uncertainties in risks to reptiles because there is a lack of exposure factors for reptiles and a lack of reptile toxicity data for the detected chemicals. As discussed in Section 7.2.1.1, one threatened reptilian species is listed as potentially present at NSWC Crane. Based on the preferred habitat of the timber rattlesnake and the ecology of UXO 7, this species may potentially inhabit areas of UXO 7. Risks to carnivorous reptiles were not specifically calculated; however, risks are accounted for by using insectivorous birds and mammals as surrogates.

7.5.2 Exposure Characterization

The contaminant dose to terrestrial wildlife is calculated using an equation that incorporates ingestion rates, body weights, BAFs, and other exposure factors. The earthworm BAF used for antimony and thallium was the default value of 1.0. For these metals, this is likely an overly conservative value, but this value may over or under estimate the true BAF. Therefore, there is uncertainty in using this value. The exposure factors were obtained from literature studies or predicted using various equations. Ingestion rates and body weights vary among species, especially among species inhabiting different areas. This was taken into account when selecting exposure parameters from U.S. EPA (1993), and an attempt was made to minimize the uncertainties associated with the exposure characterization by selecting exposure parameters from studies conducted in Indiana and surrounding states.

Bioaccumulation of contaminants into various biological media (e.g., plants, invertebrates, small mammals) depends on characteristics of the media such as pH, organic carbon, etc. Therefore, actual BAFs at the sites may be different than those used in the SERA and obtained from the literature. Also, the bioavailability of contaminants reported in toxicity studies is typically greater than the contaminants in environmental media. Typically, highly bioavailable forms of the chemicals are used when conducting toxicity tests and/or conducting dosing studies for wildlife.

There is uncertainty in the chemical data collected at the site. Measured levels of chemicals are only estimates of true site chemical concentrations. At UXO 7, samples were deliberately biased toward known or suspected high concentrations, so predicted doses are probably higher than actual doses. Whereas this is a conservative approach in predicting exposure concentrations, actual exposure of ecological receptors to chemical concentrations at UXO 7 is likely overestimated. In particular, wildlife that typically roam over multiple sample locations are unlikely to obtain all of their food from within the most contaminated areas at UXO 7. There is also uncertainty in extrapolating XRF data to laboratory-equivalent concentrations, as discussed in Section 7.3.2. These data may over or under predict actual lead concentrations.

7.5.3 Ecological Effects Data

Several alternative benchmark values were used to gain a better understanding of the relationship between maximum concentrations of selected COPCs to the overall ecological assessment of the site. There is some uncertainty involved when using these alternative benchmarks; however, attempts have been made to lessen the uncertainties by providing the toxicological basis of the alternate benchmarks when they were used.

7.5.4 Risk Characterization

Risks are possible if an EEQ is greater than or equal to 1.0 regardless of the magnitude of the EEQ. However, the magnitude of effects to ecological receptors cannot be inferred based on the magnitude of the EEQ. Rather, an EEQ greater than 1.0 simply indicates that the dose used to derive the toxicity reference value was exceeded.

Finally, there is uncertainty in how the predicted risks to a species at a site translate into risk to the population in the area as a whole.

7.6 ECOLOGICAL RISK SUMMARY AND CONCLUSIONS

A SERA was performed for UXO 7. Several chemicals were retained as COPCs as a result of the initial screening of surface soil. These chemicals were further evaluated as a part of the Step 3a refinement. Tables 7-5, 7-6, and 7-7 present summaries of the Step 3a evaluations including the overall conclusion of whether chemicals initially selected as COPCs are retained as COPCs after the refined evaluation. Tables 7-15, 7-16, and 7-17 summarize the Step 3a evaluations for chemicals with NOAEL EEQs greater than 1.0 in the average food-chain model.

In summary, the list of chemicals initially selected as soil COPCs were further evaluated in Step 3a, the first step of the BERA. After a review of alternate toxicity information (based on soil invertebrates and plants) for the initial COPCs was conducted, COPC concentrations were compared to the alternate toxicity information. For the Northern Zone, copper and lead were retained as COPCs because concentrations in this zone were greater than screening levels and alternate benchmarks. For the Central Zone and Southern Zone, no chemicals were retained as COPCs.

The chemicals selected as COPCs for risks to wildlife were further evaluated in Step 3a using conservative and less conservative exposure assumptions. In the Northern Zone, lead was retained as a COPC for further evaluation for vermivorous birds because the NOAEL EEQ for the woodcock based on less conservative food-chain models was much greater than 1.0. In the Central and Southern Zones, none of the food-chain model EEQs was much greater than 1.0.

TABLE 7-1

XRF LEAD TO LABORATORY EQUIVALENT CONCENTRATIONS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

SAMPLE	LAB LEAD	XRF LEAD	XRF LEAD CONVERTED TO LAB EQUIVALENT
X7SS0010002	NA	49.5	44
X7SS0020002	22.8	61	55
X7SS0030002	140	101.67	96
X7SS0040002	125	254	258
X7SS0050002	NA	74.33	68
X7SS0060002	NA	0 U	NA
X7SS0070002	NA	0 U	NA
X7SS0080002	NA	42.33	37
X7SS0090002	NA	47	42
X7SS0090002D	NA	83.33	77
X7SS0100002	NA	88.67	83
X7SS0110002	NA	0 U	NA
X7SS0120002	43.9	45.67	40
X7SS0130002	NA	49.67	44
X7SS0140002	NA	61	55
X7SS0150002	NA	38	33
X7SS0160002	NA	39	34
X7SS0170002	NA	49.33	44
X7SS0180002	NA	113.67	108
X7SS0190002	537	255.33	259
X7SS0200002	NA	33.67	29
X7SS0210002	NA	36	31
X7SS0220002	NA	0 U	NA
X7SS0230002	NA	30	26
X7SS0240002	NA	30	26
X7SS0250002	NA	34	29
X7SS0260002	NA	29	25
X7SS0270002	NA	0 U	NA
X7SS0280002	NA	30.5	26
X7SS0290002	NA	0 U	NA
X7SS0300002	NA	48.67	43
X7SS0310002	NA	37	32
X7SS0320002	NA	33.67	29
X7SS0330002	NA	32	28
X7SS0340002	NA	0 U	NA
X7SS0350002	NA	0 U	NA
X7SS0360002	NA	0 U	NA
X7SS0370002	NA	43.33	38
X7SS0380002	NA	213.33	213
X7SS0390002	495	382	400
X7SS0400002	NA	124	119
X7SS0410002	NA	30.67	26
X7SS0420002	NA	0 U	NA

TABLE 7-1

XRF LEAD TO LABORATORY EQUIVALENT CONCENTRATIONS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

SAMPLE	LAB LEAD	XRF LEAD	XRF LEAD CONVERTED TO LAB EQUIVALENT
X7SS0430002	NA	62	56
X7SS0440002	199	204	203
X7SS0450002	286	562	607
X7SS0460002	1100	701	771
X7SS0470002	NA	69.33	63
X7SS0480002	190	146.33	142
X7SS0490002	NA	28	24
X7SS0500002	NA	62.67	57
X7SS0510002	NA	35	30
X7SS0520002	NA	39	34
X7SS0530002	NA	37	32
X7SS0540002	NA	31	27
X7SS0550002	1160	741	818
X7SS0560002	NA	0 U	NA
X7SS0570002	NA	0 U	NA
X7SS0580002	NA	105	99
X7SS0590002	NA	29	25
X7SS0600002	NA	0 U	NA
X7SS0610002	NA	0 U	NA
X7SS0620002	NA	27	23
X7SS0630002	NA	0 U	NA
X7SS0640002	NA	0 U	NA
X7SS0650002	NA	33	29
X7SS0660002	10.3	28.5	24
X7SS0670002	NA	0 U	NA
X7SS0680002	NA	0 U	NA
X7SS0690002	NA	0 U	NA
X7SS0700002	NA	22	18
X7SS0710002	NA	0 U	NA
X7SS0720002	NA	29	25
X7SS0730002	NA	41	36
X7SS0740002	NA	38	33
X7SS0750002	33.1	29.67	25
X7SS0760002	NA	0 U	NA
X7SS0770002	NA	0 U	NA
X7SS0780002	NA	28	24
X7SS0790002	NA	0 U	NA
X7SS0800002	NA	41	36
X7SS0810002	NA	34	29
X7SS0820002	NA	32	28
X7SS0830002	NA	0 U	NA
X7SS0840002	NA	0 U	NA
X7SS0850002	NA	41	36

TABLE 7-1

XRF LEAD TO LABORATORY EQUIVALENT CONCENTRATIONS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

SAMPLE	LAB LEAD	XRF LEAD	XRF LEAD CONVERTED TO LAB EQUIVALENT
X7SS0860002	NA	0 U	NA
X7SS0870002	NA	0 U	NA
X7SS0880002	NA	29	25
X7SS0890002	NA	29	25
X7SS0900002	NA	40	35
X7SS0910002	NA	0 U	NA
X7SS0920002	NA	26	22
X7SS0930002	NA	0 U	NA
X7SS0940002	NA	0 U	NA
X7SS0950002	NA	50	45
X7SS0960002	NA	0 U	NA
X7SS0970002	NA	0 U	NA
X7SS0980002	NA	0 U	NA
X7SS0990002	NA	37.33	33
X7SS1000002	NA	0 U	NA
X7SS1010002	NA	37	32
X7SS1020002	NA	45.5	40
X7SS1030002	NA	27	23
X7SS1040002	NA	29	25
X7SS1050002	NA	31	27
X7SS1060002	NA	0 U	NA
X7SS1070002	NA	28	24
X7SS1080002	NA	25.67	22
X7SS1090002	NA	25.67	22
X7SS1100002	NA	41	36
X7SS1110002	NA	36	31
X7SS1120002	NA	35	30
X7SS1130002	NA	31	27
X7SS1140002	NA	0 U	NA
X7SS1150002	NA	31	27
X7SS1160002	NA	0 U	NA
X7SS1170002	NA	30.67	26
X7SS1180002	NA	31.33	27
X7SS1190002	NA	37	32
X7SS1200002	NA	27	23
X7SS1210002	NA	30.67	26
X7SS1220002	NA	38	33
X7SS1230002	NA	37.5	33
X7SS1240002	NA	41.33	36
X7SS1250002	NA	32	28
X7SS1260002	NA	44.33	39
X7SS1270002	25.3	35	30
X7SS1280002	NA	33.5	29

TABLE 7-1

XRF LEAD TO LABORATORY EQUIVALENT CONCENTRATIONS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

SAMPLE	LAB LEAD	XRF LEAD	XRF LEAD CONVERTED TO LAB EQUIVALENT
X7SS1290002	NA	46	41
X7SS1300002	NA	37	32
X7SS1310002	NA	43.33	38
X7SS1320002	NA	37.33	33
X7SS1330002	NA	31	27
X7SS1340002	NA	34	29
X7SS1350002	NA	43.67	39
X7SS1360002	NA	30.67	26
X7SS1370002	NA	29	25
X7SS1380002	NA	31	27
X7SS1390002	NA	44.67	40
X7SS1400002	NA	40.5	36
X7SS1410002	NA	31	27
X7SS1420002	NA	30.67	26
X7SS1430002	NA	41.67	37
X7SS1440002	NA	0 U	NA
X7SS1450002	NA	61.67	56
X7SS1460002	NA	39.33	34
X7SS1470002	NA	71	65
X7SS1480002	71.8	148	144
X7SS1490002	NA	55.33	50
X7SS1500002	NA	30.33	26
X7SS1510002	NA	28.67	24
X7SS1520002	460	247.33	250
X7SS1530002	NA	71.67	66
X7SS1540002	NA	25	21
X7SS1550002	NA	25.67	22
X7SS1560002	NA	27	23
X7SS1570002	NA	41.33	36
X7SS1580002	NA	27	23
X7SS1590002	NA	24.5	21
X7SS1600002	NA	30.67	26
X7SS1610002	NA	73	67
X7SS1620002	NA	194.33	193
X7SS1630002	NA	71.67	66
X7SS1640002	NA	133.33	129
X7SS1650002	NA	128.67	124
X7SS1660002	NA	50.67	45
X7SS1670002	72.2	101	95
X7SS1680002	NA	41.67	37
X7SS1690002	NA	18	15
X7SS1700002	NA	237.67	240
X7SS1710002	NA	24.33	21

TABLE 7-1

XRF LEAD TO LABORATORY EQUIVALENT CONCENTRATIONS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

SAMPLE	LAB LEAD	XRF LEAD	XRF LEAD CONVERTED TO LAB EQUIVALENT
X7SS1730002	125	121.33	116
X7SS1740002	430	442.33	469
X7SS1750002	170	96	90
X7SS1760002	NA	147.33	143
X7SS1770002	115	114.67	109
X7SS1780002	40.9	29.67	25
X7SS1790002	83.6	104	98
X7SS1800002	89	84.67	79
X7SS1810002	212	202.33	202
X7SS1820002	95.1	109	103
X7SS1830002	28.8	24.67	21
X7SS1840002	25.3	25.67	22
X7SS1850002	NA	24.33	21
X7SS1860002	NA	32	28
X7SS1870002	NA	21	18
X7SS1880002	NA	23.67	20
X7SS1890002	151	165.67	163
X7SS1900002	NA	334.67	347

NA - Not applicable/ not available

TABLE 7-2

ECOLOGICAL COPC SELECTION - NORTHERN ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Parameter	Frequency of Detection	Minimum Concentration	Maximum Concentration	Sample Containing Maximum Detection	Average of Positive Results	Average of All Results (1)	Ecological Screening Level (2)	EEQ	COPC for Plants/ Invertebrates (3)	Rationale for COPC Selection (4)	Selected for Food Chain Modeling (3)	Rationale for Food Chain Modeling Selection (4)
Inorganics (mg/kg)												
Aluminum	18/18	9300	19400	X7SS1830002	13761	13761	pH (5, 7)	NA	No	BSL	No	NONBIO
Antimony	16/18	0.98 J	96.2 J	X7SS0390002	13.1	11.7	0.27 (5)	356	Yes	ASL	Yes	ASL
Arsenic	18/18	5.52	17	X7SS1830002	10.4	10.4	18 (5)	0.94	No	BSL	No	BSL
Barium	18/18	56.2	118	X7SS1810002	80.7	80.7	330 (5)	0.4	No	BSL	No	NONBIO
Beryllium	18/18	0.553	1.2	X7SS1810002	0.754	0.754	21 (5)	0.06	No	BSL	No	NONBIO
Cadmium	18/18	0.387	2.21	X7SS1750002	1.03	1.03	0.36 (5)	6.1	Yes	ASL	Yes	BIO
Calcium	18/18	735	26700	X7SS0390002	3731	3731	NUT	NA	No	NUT	No	NUT
Chromium	18/18	16.7	57	X7SS1770002	27.8	27.8	26 (5)	2.2	Yes	ASL	Yes	BIO
Cobalt	18/18	9.72	22.8	X7SS1820002	15.1	15.1	13 (5)	1.8	Yes	ASL	No	NONBIO
Copper	18/18	16.9	283	X7SS0460002	81.3	81.3	28 (5)	10	Yes	ASL	Yes	BIO
Iron	18/18	20900	51900	X7SS1750002	33050	33050	pH (5, 8)	NA	No	BSL	No	NONBIO
Lead, Labeqv	31/34	23.87	1160	X7SS0550002	199	182	11 (5)	105	Yes	ASL	Yes	BIO
Magnesium	18/18	723	7000	X7SS0390002	1984	1984	NUT	NA	No	NUT	No	NUT
Manganese	18/18	334	1310	X7SS1750002	748	748	220 (5)	6.0	Yes	ASL	No	NONBIO
Nickel	18/18	11.7	32.4	X7SS1810002	19.9	19.9	38 (5)	0.9	No	BSL	No	BSL
Potassium	18/18	579	1740	X7SS1830002	905	905	NUT	NA	No	NUT	No	NUT
Selenium	18/18	0.249	0.913	X7SS1830002	0.46	0.46	0.52 (5)	1.8	Yes	ASL	No	BLBKG
Silver	18/18	0.0593	0.238	X7SS1830002	0.121	0.121	4.2 (5)	0.06	No	BSL	No	BSL
Sodium	4/18	40.9	138	X7SS1800002	103	40.4	NUT	NA	No	NUT	No	NUT
Thallium	17/18	0.133	0.525	X7SS1830002	0.222	0.213	0.0569 (6)	9.2	Yes	ASL	Yes	ASL
Vanadium	18/18	25.6	85.9	X7SS1830002	44.7	44.7	7.8 (5)	11	Yes	ASL	Yes	ASL
Zinc	18/18	40.7	118	X7SS1750002	66.6	66.6	46 (5)	2.6	Yes	ASL	Yes	BIO

Notes:
Shading indicates an exceedance of the criteria.
EEQ = Ecological Effects Quotient
COPC = Chemical of Potential Concern
NUT = Essential Nutrient
NA - Not Applicable/Not Available
Lead, Labeqv = Lead concentration reported as a laboratory analysis equivalent. See Section 7.3.2 for detailed methodology.

1 - Average value determined by including nondetected concentrations as the detection limit /2
2 - Sources of Ecological Screening Levels (in order of preference):
USEPA Ecological Soil Screening Levels (2003, 2005, 2006, 2007) individual documents available at http://www.epa.gov/ecotox/ecossl/
USEPA Region 5 Ecological Screening Levels, August 22, 2003 available at http://www.epa.gov/reg5rcra/ca/edql.htm.
3 - Chemicals retained as COPCs are further evaluated in the Step 3a evaluation.
4 - Rationale for COPC selection/deletion:
ASL = Above Screening Level
BSL = Below Screening Level
BIO = Bioaccumulative chemical
NONBIO = Non-Bioaccumulative chemical
BLBKG = Below or not statistically different from background
5 - USEPA Eco-SSL
6 - USEPA Region 5
7 - Aluminum is considered a COPC only when the soil pH is less than 5.5; average soil pH at NSWC Crane is 6.7.
8 - Iron is not expected to be toxic to plants with a soil pH between 5 and 8; average soil pH at NSWC Crane is 6.7.

TABLE 7-3

ECOLOGICAL COPC SELECTION - CENTRAL ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Parameter	Frequency of Detection	Minimum Concentration	Maximum Concentration	Sample Containing Maximum Detection	Average of Positive Results	Average of All Results [1]	Ecological Screening Level[2]	EEQ	COPC for Plants/ Invertebrates[3]	Rationale for COPC Selection[4]	Selected for Food Chain Modeling[3]	Rationale for Food Chain Modeling Selection[4]
Polynuclear Aromatic Hydrocarbons (PAHS) (ug/kg)												
2-Methylnaphthalene	3/11	3.9 J	40	X7SS1210002	17.0	5.24	29000 [5]	0.001	No	BSL	No	NONBIO
Acenaphthene	4/11	4.9 J	550 J	X7SS1210002	170	62.2	29000 [5]	0.02	No	BSL	No	BSL
Acenaphthylene	1/11	27	27	X7SS1230002	27.0	2.76	29000 [5]	0.001	No	BSL	No	BSL
Anthracene	5/11	4.2 J	970	X7SS1210002	243	111	29000 [5]	0.03	No	BSL	No	BSL
Benzo(a)anthracene	7/11	10	6400	X7SS1210002	1208	769	1100 [5]	5.8	Yes	ASL	Yes	BIO
Benzo(a)pyrene	7/11	14	8100 J	X7SS1210002	1554	989	1100 [5]	7.4	Yes	ASL	Yes	BIO
Benzo(b)fluoranthene	7/11	20	12000 J	X7SS1210002	2357	1500	1100 [5]	10.9	Yes	ASL	Yes	BIO
Benzo(g,h,i)perylene	7/11	5.7 J	2900 J	X7SS1210002	581	370	1100 [5]	2.6	Yes	ASL	Yes	BIO
Benzo(k)fluoranthene	7/11	6.4 J	4700 J	X7SS1210002	889	566	1100 [5]	4.3	Yes	ASL	Yes	BIO
Chrysene	7/11	13	7400	X7SS1210002	1413	899	1100 [5]	6.7	Yes	ASL	Yes	BIO
Dibenzo(a,h)anthracene	4/11	18	970 J	X7SS1210002	302	110	1100 [5]	0.9	No	BSL	No	BSL
Fluoranthene	7/11	14	8700	X7SS1210002	1581	1006	29000 [5]	0.3	No	BSL	No	BSL
Fluorene	4/11	4.6 J	270	X7SS1210002	83.2	30.5	29000 [5]	0.01	No	BSL	No	BSL
Indeno(1,2,3-cd)pyrene	7/11	4.7 J	2900 J	X7SS1210002	573	365	1100 [5]	2.6	Yes	ASL	Yes	BIO
Phenanthrene	5/11	21	4900	X7SS1210002	1182	538	29000 [5]	0.17	No	BSL	No	BSL
Pyrene	8/11	3.2 J	14000	X7SS1210002	2278	1657	1100 [5]	12.7	Yes	ASL	Yes	BIO
Inorganics (mg/kg)												
Aluminum	3/3	8700	19400	X7SS1270002	14300	14300	pH [5, 7]	NA	No	BSL	No	NONBIO
Antimony	3/3	0.21 J	0.93 J	X7SS0750002	0.583	0.583	0.27 [5]	3	Yes	ASL	Yes	ASL
Arsenic	3/3	3.86	8.84	X7SS1270002	7.08	7.08	18 [5]	0.49	No	BSL	No	BSL
Barium	3/3	145	627	X7SS0750002	312	312	330 [5]	1.9	Yes	ASL	No	NONBIO
Beryllium	3/3	0.407	0.883	X7SS1270002	0.641	0.641	21 [5]	0.04	No	BSL	No	NONBIO
Cadmium	3/3	0.662	1.43	X7SS1270002	1.07	1.07	0.36 [5]	4.0	Yes	ASL	Yes	BIO
Calcium	3/3	763	3720	X7SS1270002	2138	2138	NUT	NA	No	NUT	No	NUT
Chromium	3/3	10.2	23.9	X7SS1270002	16.9	16.9	26 [5]	0.9	No	BSL	No	BSL
Cobalt	3/3	6.79	14.4	X7SS1270002	10.5	10.5	13 [5]	1.1	Yes	ASL	No	NONBIO
Copper	3/3	6.34	24.7	X7SS1270002	15.3	15.3	28 [5]	1	No	BSL	No	BSL
Iron	3/3	12200	26000	X7SS1270002	20400	20400	pH [5, 8]	NA	No	BSL	No	NONBIO
Lead, Labeqv	74/105	10.3	99.36	X7SS0580002	30.1	24.2	11 [5]	9	Yes	ASL	Yes	BIO
Magnesium	3/3	830	2510	X7SS1270002	1583	1583	NUT	NA	No	NUT	No	NUT
Manganese	3/3	347	770	X7SS0750002	598	598	220 [5]	3.5	Yes	ASL	No	NONBIO
Nickel	3/3	8.75	17.1	X7SS1270002	13.6	13.6	38 [5]	0.5	No	BSL	No	BSL
Potassium	3/3	476	1750	X7SS1270002	1026	1026	NUT	NA	No	NUT	No	NUT
Selenium	3/3	0.405	0.575	X7SS0750002	0.509	0.509	0.52 [5]	1.1	Yes	ASL	No	BLBKG
Silver	3/3	0.0627	0.129	X7SS1270002	0.092	0.092	4.2 [5]	0.03	No	BSL	No	BSL
Sodium	2/3	46.8	66.7	X7SS0750002	56.8	48.2	NUT	NA	No	NUT	No	NUT
Thallium	3/3	0.138	0.231	X7SS1270002	0.193	0.193	0.0569 [6]	4.1	Yes	ASL	No	NONBIO
Vanadium	3/3	19.9	38.1	X7SS1270002	30.3	30.3	7.8 [5]	5	Yes	ASL	Yes	ASL
Zinc	3/3	30.9	64.4	X7SS1270002	52.8	52.8	46 [5]	1.4	Yes	ASL	Yes	BIO

TABLE 7-3

ECOLOGICAL COPC SELECTION - CENTRAL ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Notes:
Shading indicates an exceedance of the criteria.
EEQ = Ecological Effects Quotient
COPC = Chemical of Potential Concern
NUT = Essential Nutrient
NA - Not Applicable/Not Available
Lead, Labeqv = Lead concentration reported as a laboratory analysis equivalent. See Section 7.3.2 for detailed methodology.

1 - Average value determined by including nondetected concentrations as the detection limit /2
2 - Chemicals retained as COPCs are further evaluated in the Step 3a evaluation.
3 - Rationale for COPC selection/deletion:
ASL = Above Screening Level
BSL = Below Screening Level
BIO = Bioaccumulative chemical
NONBIO = Non-Bioaccumulative chemical
BLBKG = Below or not statistically different from background
4 - Sources of Ecological Screening Levels (in order of preference):
USEPA Ecological Soil Screening Levels (2003, 2005, 2006, 2007) individual documents available at http://www.epa.gov/ecotox/ecossl/
USEPA Region 5 Ecological Screening Levels, August 22, 2003 available at http://www.epa.gov/reg5rcra/ca/edql.htm.
5 - USEPA Eco-SSL
6 - USEPA Region 5
7 - Aluminum is considered a COPC only when the soil pH is less than 5.5; average soil pH at NSWC Crane is 6.7.
8 - Iron is not expected to be toxic to plants with a soil pH between 5 and 8; average soil pH at NSWC Crane is 6.7.

TABLE 7-4

ECOLOGICAL COPC SELECTION - SOUTHERN ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Parameter	Frequency of Detection	Minimum Concentration	Maximum Concentration	Sample Containing Maximum Detection	Average of Positive Results	Average of All Results [1]	Ecological Screening Level[2]	EEQ	COPC for Plants/ Invertebrates[3]	Rationale for COPC Selection[4]	Selected for Food Chain Modeling[3]	Rationale for Food Chain Modeling Selection[4]
Inorganics (mg/kg)												
Aluminum	8/8	7910	18400	X7SS1670002	12689	12689	pH [5, 7]	NA	No	BSL	No	NONBIO
Antimony	7/8	0.73 J	11.1 J	X7SS0040002	4.32	3.82	0.27 [5]	41	Yes	ASL	Yes	ASL
Arsenic	8/8	5.69	16.4	X7SS0030002	9.76	9.76	18 [5]	0.91	No	BSL	No	BSL
Barium	8/8	95.6	949	X7SS0040002	326	326	330 [5]	2.9	Yes	ASL	No	NONBIO
Beryllium	8/8	0.67	1.35	X7SS0030002	0.937	0.937	21 [5]	0.06	No	BSL	No	NONBIO
Cadmium	8/8	0.683	1.79	X7SS1670002	1.09	1.09	0.36 [5]	5.0	Yes	ASL	Yes	BIO
Calcium	8/8	1810	18000	X7SS1520002	6688	6688	NUT	NA	No	NUT	No	NUT
Chromium	8/8	18.7	66.6	X7SS0030002	28.7	28.7	26 [5]	2.6	Yes	ASL	Yes	BIO
Cobalt	8/8	11.4	21.9	X7SS0020002	15.5	15.5	13 [5]	1.7	Yes	ASL	No	NONBIO
Copper	8/8	20.5	427	X7SS0190002	83.0	83.0	28 [5]	15	Yes	ASL	Yes	BIO
Iron	8/8	22400	90700	X7SS0030002	40088	40088	pH [5, 8]	NA	No	BSL	No	NONBIO
Lead, Labeqv	46/50	14.82	537	X7SS0190002	78.0	72.6	11 [5]	49	Yes	ASL	Yes	BIO
Magnesium	8/8	923	5840	X7SS1520002	2268	2268	NUT	NA	No	NUT	No	NUT
Manganese	8/8	694	1370	X7SS0120002	1034	1034	220 [5]	6.2	Yes	ASL	No	NONBIO
Nickel	8/8	16.8	50.2	X7SS0030002	26.9	26.9	38 [5]	1.3	Yes	ASL	Yes	BIO
Potassium	8/8	626	2380	X7SS1670002	1511	1511	NUT	NA	No	NUT	No	NUT
Selenium	8/8	0.46	0.81	X7SS1670002	0.629	0.629	0.52 [5]	1.6	Yes	ASL	Yes	BIO
Silver	8/8	0.0984	0.144	X7SS1670002	0.1118	0.1118	4.2 [5]	0.03	No	BSL	No	BSL
Thallium	8/8	0.0808	0.25	X7SS0020002	0.173	0.173	0.0569 [6]	4.4	Yes	ASL	No	NONBIO
Vanadium	8/8	23.7	46.3	X7SS0030002	32.3	32.3	7.8 [5]	6	Yes	ASL	Yes	ASL
Zinc	8/8	58.5	148	X7SS0190002	89.3	89.3	46 [5]	3.2	Yes	ASL	Yes	BIO

Notes:
Shading indicates an exceedance of the criteria.
EEQ = Ecological Effects Quotient
COPC = Chemical of Potential Concern
NUT = Essential Nutrient
NA - Not Applicable/Not Available
Lead, Labeqv = Lead concentration reported as a laboratory analysis equivalent. See Section 7.3.2 for detailed methodology.

1 - Average value determined by including nondetected concentrations as the detection limit /2
2 - Sources of Ecological Screening Levels (in order of preference):
USEPA Ecological Soil Screening Levels (2003, 2005, 2006, 2007) individual documents available at http://www.epa.gov/ecotox/ecossl/
USEPA Region 5 Ecological Screening Levels, August 22, 2003 available at http://www.epa.gov/reg5rcra/ca/edql.htm.
3 - Chemicals retained as COPCs are further evaluated in the Step 3a evaluation.
4 - Rationale for COPC selection/deletion:
ASL = Above Screening Level
BSL = Below Screening Level
BIO = Bioaccumulative chemical
NONBIO = Non-Bioaccumulative chemical
BLBKG = Below or not statistically different from background
5 - USEPA Eco-SSL
6 - USEPA Region 5
7 - Aluminum is considered a COPC only when the soil pH is less than 5.5; average soil pH at NSWC Crane is 6.7.
8 - Iron is not expected to be toxic to plants with a soil pH between 5 and 8; average soil pH at NSWC Crane is 6.7.

TABLE 7-5

STEP 3A EVALUATION FOR RISKS TO PLANTS AND INVERTEBRATES SURFACE SOIL COPCs - NORTHERN ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical of Potential Concern (COPC)	Frequency of Detection	Maximum Detected Concentration	Ecological Screening Level (ESL)[1]	Maximum EEQ[2]	Number of Samples > ESL[3]	Step 3a Evaluation [4]						Risk Determination (Acceptable/ Unacceptable)	Retained as a COPC?
						Eco-SSL		Alternate Benchmarks					
								Canadian SQG	ORNL Benchmarks				
						Plants	Invertebrates		Plants	Earthworms	Other Step 3a Factors Considered in Evaluation		
Inorganics (mg/kg)													
Antimony	16/18	96.2	0.27	356	16	NA	78	NA	5	NA	- All detected concentrations except the maximum detected antimony concentration (96.2 mg/kg) in sample X7SS0390002 were less than the invertebrate Eco-SSL. - The northern zone is vegetated. - The ORNL benchmark was based on experimental data using highly bioavailable salts; the antimony in soils of the Northen Zone is likely less bioavailable.	Acceptable	NO
Cadmium	18/18	2.21	0.36	6	18	32	140	NA	NA	NA	- Maximum concentration is less than the plant and invertebrate Eco-SSLs.	Acceptable	NO
Chromium	18/18	57	26	2	8	NA	NA	64	NA	NA	- Maximum concentration is less than the Canadian SQG.	Acceptable	NO
Cobalt	18/18	22.8	13	2	12	13	NA	NA	NA	NA	- Detected concentrations are not statistically different than background	Acceptable	NO
Copper	18/18	283	28	10.1	17	70	80	NA	NA	NA	- Maximum concentration is greater than the plant and invertebrate Eco-SSLs. - Average concentration is greater than the plant and invertebrate Eco-SSLs. - Many detected concentrations are greater than the plant and invertebrate Eco-SSLs.	Unacceptable	YES
Lead	31/34	1160	11	105	31	120	1700	NA	NA	NA	- Maximum concentration is greater than the plant Eco-SSL. - Average concentrations are greater than the plant Eco-SSL. - Many detected concentrations are greater than the plant Eco-SSL.	Unacceptable	YES
Manganese	18/18	1310.0	220	6	18	220	450	NA	NA	NA	- Detected concentrations appear statistically less than background.	Acceptable	NO
Selenium	18/18	0.9	0.52	2	6	0.52	4.1	NA	NA	NA	- Detected concentrations do not appear statistically different than background.	Acceptable	NO
Thallium	17/18	0.525	0.0569	9.2	17	NA	NA	1.4	NA	NA	- Maximum concentration is less than the Canadian SQG.	Acceptable	NO
Vanadium	18/18	85.9	7.8	11	18	NA	NA	130	NA	NA	- Maximum concentration is less than the Canadian SQG.	Acceptable	NO
Zinc	18/18	118	46	2.6	16	160	120	NA	NA	NA	- Maximum concentration is less than the plant and invertebrate Eco-SSLs.	Acceptable	NO

Footnotes:
1 ESL is the lowest Eco-SSL or Region 5 Ecological Screening Level. See Table 7-2 for screening level source.
2 Maximum EEQ = Maximum detection divided by the screening level.
3 Number of samples with concentrations greater than the screening level.
4 See Section 7.4.1.1 for a more detailed Step 3a evaluation.

EEQ = Ecological Effects Quotient
NA = Not Available or Not Applicable
SQG = Soil Quality Guideline
Eco-SSL = U.S. EPA Ecological Soil Screening Level
ORNL = Oak Ridge National Laboratory
ESL = Ecological Screening Level

TABLE 7-6

STEP 3A EVALUATION FOR RISKS TO PLANTS AND INVERTEBRATES SURFACE SOIL COPCs - CENTRAL ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical of Potential Concern (COPC)	Frequency of Detection	Maximum Detected Concentration	Ecological Screening Level (ESL)(1)	Maximum EEQ(2)	Number of Samples > ESL(3)	Step 3a Evaluation (4)						Risk Determination (Acceptable/ Unacceptable)	Retained as a COPC?
						Eco-SSL		Alternate Benchmarks					
								Canadian SQG	ORNL Benchmarks				
						Plants	Invertebrates		Plants	Earthworms	Other Step 3a Factors Considered in Evaluation		
Inorganics (mg/kg)													
Antimony	3/3	0.93	0.27	3.4	2	NA	78	NA	5	NA	- Maximum concentration is less than the invertebrate Eco-SSL. - Maximum concentration is less than the ORNL plant bernchmark.	Acceptable	NO
Barium	3/3	627	330	1.9	1	NA	330	NA	500	NA	- Only the maximum detection is greater than the plant and invertebrate Eco-SSLs. - Average concentration is less than the plant and invertebrate Eco-SSLs.	Acceptable	NO
Cadmium	3/3	1.4	0.36	4	3	32	140	NA	NA	NA	- Maximum concentration is less than the plant and invertebrate Eco-SSLs.	Acceptable	NO
Cobalt	3/3	14.4	13	1		13	NA	NA	NA	NA	- Doesn't appear statistically greater than background.	Acceptable	NO
Lead	74/105	99	11	9	73	120	1700	NA	NA	NA	- Maximum concentration is less than the plant and invertebrate Eco-SSLs.	Acceptable	NO
Manganese	3/3	770	220	4	3	220	450	NA	NA	NA	- Detected concentrations are less than the 95th percentile for background concentrations in the East. - The site is vegetated.	Acceptable	NO
Selenium	3/3	0.575	0.52	1	2	0.52	4.1	NA	NA	NA	- Doesn't appear statistically greater than background	Acceptable	NO
Thallium	3/3	0.231	0.057	4	3	NA	NA	1.4	NA	NA	- Doesn't appear statistically greater than background	Acceptable	NO
Vanadium	3/3	38	8	5	3	NA	NA	130	NA	NA	- Maximum concentration is less than the Canadian SQG.	Acceptable	NO
Zinc	3/3	64	46	1	2	160	120	NA	NA	NA	- Maximum concentration is less than the plant and invertebrate Eco-SSLs.	Acceptable	NO
Polynuclear Aromatic Hydrocarbons (µg/kg)													
Benzo(a)anthracene	7/11	6400	1100	5.8	2	NA	18000	4400000(5)	NA	NA	- Maximum concentration is less than the invertebrate Eco-SSL. - Maximum detection is well below the NOEC for plants in the Appendix of the benzo(a)pyrene Canadian SQG.	Acceptable	NO
Benzo(a)pyrene	7/11	8100	1100	7.4	2	NA	18000	4400000(5)	NA	NA	- Maximum concentration is less than the invertebrate Eco-SSL. - Maximum detection is well below the NOEC for plants in the Appendix of the benzo(a)pyrene Canadian SQG.	Acceptable	NO
Benzo(b)fluoranthene	7/11	12000	1100	10.9	3	NA	18000	4400000(5)	NA	NA	- Maximum concentration is less than the invertebrate Eco-SSL. - Maximum detection is well below the NOEC for plants in the Appendix of the benzo(a)pyrene Canadian SQG.	Acceptable	NO
Benzo(g,h,i)perylene	7/11	2900	1100	2.6	1	NA	18000	4400000(5)	NA	NA	- Maximum concentration is less than the invertebrate Eco-SSL. - Maximum detection is well below the NOEC for plants in the Appendix of the benzo(a)pyrene Canadian SQG.	Acceptable	NO
Benzo(k)fluoranthene	7/11	4700	1100	4.3	1	NA	18000	4400000(5)	NA	NA	- Maximum concentration is less than the invertebrate Eco-SSL. - Maximum detection is well below the NOEC for plants in the Appendix of the benzo(a)pyrene Canadian SQG.	Acceptable	NO
Chrysene	7/11	7400	1100	6.7	2	NA	18000	4400000(5)	NA	NA	- Maximum concentration is less than the invertebrate Eco-SSL. - Maximum detection is well below the NOEC for plants in the Appendix of the benzo(a)pyrene Canadian SQG.	Acceptable	NO
Indeno(1,2,3-cd)pyrene	7/11	2900	1100	2.6	1	NA	18000	4400000(5)	NA	NA	- Maximum concentration is less than the invertebrate Eco-SSL. - Maximum detection is well below the NOEC for plants in the Appendix of the benzo(a)pyrene Canadian SQG.	Acceptable	NO
Pyrene	8/11	14000	1100	12.7	3	NA	18000	4400000(5)	NA	NA	- Maximum concentration is less than the invertebrate Eco-SSL. - Maximum detection is well below the NOEC for plants in the Appendix of the benzo(a)pyrene Canadian SQG.	Acceptable	NO

Footnotes:
1 ESL is the lowest Eco-SSL or Region 5 Ecological Screening Level. See Table 7-3 for screening level source.
2 Maximum EEQ = Maximum detection divided by the screening level.
3 Number of samples with concentrations greater than the screening level.
4 See Section 7.4.1.2 for a more detailed Step 3a evaluation.
5 Value is based on the lowest reported NOEC value in Appendix III of the Canadian SQG for benzo(a)pyrene.

EEQ = Ecological Effects Quotient
NA = Not Available or Not Applicable
SQG = Soil Quality Guideline
Eco-SSL = U.S. EPA Ecological Soil Screening Level
ORNL = Oak Ridge National Laboratory
ESL = Ecological Screening Level

TABLE 7-7

STEP 3A EVALUATION FOR RISKS TO PLANTS AND INVERTEBRATES SURFACE SOIL COPCs - SOUTHERN ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical of Potential Concern (COPC)	Frequency of Detection	Maximum Detected Concentration	Ecological Screening Level (ESL)(1)	Maximum EEQ(2)	Number of Samples > ESL(3)	Step 3a Evaluation (4)						Risk Determination (Acceptable/ Unacceptable)	Retained as a COPC?
						Eco-SSL		Alternate Benchmarks					
								Canadian SQG	ORNL Benchmarks				
						Plants	Invertebrates		Plants	Earthworms	Other Step 3a Factors Considered in Evaluation		
Inorganics (mg/kg)													
Antimony	7/8	11.1	0.27	41	7	NA	78	NA	5	NA	- All detected concentrations were less than the invertebrate Eco-SSL. - The Southern Zone is vegetated and the average antimony concentration is 4.31 mg/kg. - The ORNL plant benchmark was based on experimental data using highly bioavailable salts; the antimony in soils of the Southern Zone is likely less bioavailable.	Acceptable	NO
Barium	8/8	949	330	2.9	2	70	80	NA	NA	NA	- Only the maximum detection is greater than the plant and invertebrate Eco-SSLs. - Average concentration (325 mg/kg) is less than the plant and invertebrate Eco-SSLs.	Acceptable	NO
Cadmium	8/8	1.8	0.36	5	8	32	140	NA	NA	NA	- Maximum concentration is less than the plant and invertebrate Eco-SSLs.	Acceptable	NO
Chromium	8/8	66.6	26	2.6	2	NA	NA	64	NA	NA	- All detected concentrations except the maximum are less than the Canadian SQG. - The maximum only slightly exceed the Canadian SQG.	Acceptable	NO
Cobalt	8/8	21.9	13	1.7	6	13	NA	NA	NA	NA	- Detected concentrations not statistically different than background.	Acceptable	NO
Copper	8/8	427	28	15.3	5	70	80	NA	NA	NA	- Only the maximum detected concentration is greater than the plant and invertebrate Eco-SSLs - Average concentration is only slightly greater than the plant and invertebrate Eco-SSLs. - Copper concentrations around the maximum detected concentrationm are likely bound by much lower concentrations based on low lead concentrations in adjacent samples.	Acceptable	NO
Lead	46/50	537	11	48.8	46	120	1700	NA	NA	NA	- Maximum concentration is less than the invertebrate Eco-SSL. - Average concentration is less than the plant Eco-SSL. - The maximum detection is bounded to the east and west by samples with lead concentrations below the plant Eco SSL. - The Southern Zone is covered with vegetation.	Acceptable	NO
Manganese	8/8	1370.0	220	6.2	8	220	450	NA	NA	NA	- Detected concentrations not statistically different than background.	Acceptable	NO
Nickel	8/8	50.2	38	1.32	1	38	280	NA	NA	NA	- Maximum concentration is less than the invertebrate Eco-SSL. - Only the maximum detection (50.2 mg/kg) at X7SS0030002 exceeded the plant Eco-SSL - The maximum is bounded to the west by two samples (X7SS0020002 and X7SS0040002) with concentrations well below the plant Eco-SSL - The Southern Zone is covered with vegetation.	Acceptable	NO
Selenium	8/8	0.8	0.52	1.6	7	0.52	4.1	NA	NA	NA	- Detected concentrations are only slightly higher than the plant Eco SSL. - The maximum detected selenium concentration is within the 95th percentile of the Eastern regional background range and the average concentration is below the 75th percentile. - The average selenium concentration is only slightly greater than the average basewide background concentration of 0.48 mg/kg. - The Southern Zone is covered with vegetation.	Acceptable	NO
Thallium	8/8	0.3	0.057	4.4	8	NA	NA	1.4	NA	NA	- Detected concentrations not statistically different than background.	Acceptable	NO
Vanadium	8/8	46.3	7.8	5.9	8	NA	NA	130	NA	NA	- Maximum concentration is less than the Canadian SQG.	Acceptable	NO
Zinc	8/8	148	46	3.2	8	160	120	NA	NA	NA	- Maximum concentration is less than the plant Eco-SSL. - Only the maximum detection (148 mg/kg) at X7SS019 exceeded the invertebrate Eco-SSL. - The maximum only slightly exceeds the invertebrate Eco-SSL. - Average concentration (89.3 mg/kg) is less than the plant and invertebrate Eco-SSLs.	Acceptable	NO

Footnotes:
1 ESL is the lowest Eco-SSL or Region 5 Ecological Screening Level. See Table 7-4 for screening level source.
2 Maximum EEQ = Maximum detection divided by the screening level.
3 Number of samples with concentrations greater than the screening level.
4 See Section 7.4.1.3 for a more detailed Step 3a evaluation.

EEQ = Ecological Effects Quotient
NA = Not Available or Not Applicable
SQG = Soil Quality Guideline
Eco-SSL = U.S. EPA Ecological Soil Screening Level
ORNL = Oak Ridge National Laboratory
ESL = Ecological Screening Level

TABLE 7-8

EXPOSURE PARAMETERS FOR THE TERRESTRIAL WILDLIFE MODEL
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Species/Exposure Inputs	Conservative Inputs		Average Inputs	
	Values	Units	Values	Units
Meadow Vole				
Body Weight = BW	3.290E-02	kg	3.663E-02	kg
Food Ingestion Rate = If	3.840E-03	kg/day	3.570E-03	kg/day
Soil Ingestion Rate - Is	1.229E-04	kg/day	4.284E-05	kg/day
Home Range = HR	Assume 100% on site		1.640E-01	acres
Short-Tailed Shrew				
Body Weight = BW	1.525E-02	kg	1.687E-02	kg
Food Ingestion Rate = If	2.592E-03	kg/day	1.648E-03	kg/day
Soil Ingestion Rate - Is	7.776E-05	kg/day	1.483E-05	kg/day
Home Range = HR	Assume 100% on site		9.700E-01	acres
American Woodcock				
Body Weight = BW	1.660E-01	kg	1.895E-01	kg
Food Ingestion Rate = If	3.032E-02	kg/day	2.526E-02	kg/day
Soil Ingestion Rate - Is	4.972E-03	kg/day	1.617E-03	kg/day
Home Range = HR	Assume 100% on site		6.133E+01	acres
Bobwhite Quail				
Body Weight = BW	1.620E-01	kg	1.770E-01	kg
Food Ingestion Rate = If	4.920E-03	kg/day	4.320E-03	kg/day
Soil Ingestion Rate - Is	6.839E-04	kg/day	2.635E-04	kg/day
Home Range = HR	Assume 100% on site		2.860E+01	acres

The exposure factors were derived as presented in Appendix G.
The exposure parameters from U.S. EPA (1993) were converted to dry-weight values for the food-chain model calculations.
The soil ingestion rates were calculated by multiplying the food ingestion rates by the following incidental soil ingestion rates:

	Conservative	Average	Source
Bobwhite Quail	13.90%	6.10%	1, 2
Meadow Vole	3.20%	1.20%	1
American Woodcock	16.40%	6.40%	1
Short-tailed Shrew	3%	0.90%	1

1 - USEPA, 2007.
2 - Based on the mourning dove.

TABLE 7-9

TERRESTRIAL WILDLIFE MODEL NOAEL AND LOAEL EEQS-CONSERVATIVE EXPOSURE ASSUMPTIONS - NORTHERN ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical	Meadow Vole		Bobwhite Quail		Short-Tailed Shrew		American Woodcock	
	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ
Inorganics								
ANTIMONY	8.26E+00	1.77E-01	#VALUE!	#VALUE!	2.85E+02	6.10E+00	#VALUE!	#VALUE!
CADMIUM	1.56E-01	1.74E-02	2.62E-02	6.06E-03	3.45E+00	3.85E-01	1.98E+00	4.58E-01
CHROMIUM	2.02E-01	8.35E-03	1.17E-01	1.99E-02	1.35E+00	5.60E-02	1.84E+00	3.13E-01
COPPER	5.65E-01	3.82E-02	4.30E-01	5.00E-02	4.68E+00	3.17E-01	8.67E+00	1.01E+00
LEAD	1.27E+00	3.19E-02	3.26E+00	1.19E-01	9.90E+00	2.50E-01	4.81E+01	1.76E+00
THALLIUM	8.55E+00	8.55E-01	#VALUE!	#VALUE!	1.24E+01	1.24E+00	#VALUE!	#VALUE!
VANADIUM	8.88E-02	3.91E-02	1.09E+00	2.21E-01	2.53E-01	1.11E-01	9.40E+00	1.90E+00
ZINC	1.11E-01	2.81E-02	3.87E-02	1.50E-02	9.30E-01	2.35E-01	1.18E+00	4.58E-01

-cells are shade if the EEQ > 1.0
EEQ = Ecological Effects Quotient
#VALUE! = Value not able to be calculated

TABLE 7-10

TERRESTRIAL WILDLIFE MODEL NOAEL AND LOAEL EEQS-LESS CONSERVATIVE EXPOSURE ASSUMPTIONS - NORTHERN ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical	Meadow Vole		Bobwhite Quail		Short-Tailed Shrew		American Woodcock	
	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ
Inorganics								
ANTIMONY	4.29E-01	9.18E-03	#VALUE!	#VALUE!	1.96E+01	4.18E-01	#VALUE!	#VALUE!
CADMIUM	8.18E-02	9.12E-03	1.16E-02	2.68E-03	1.08E+00	1.21E-01	7.79E-01	1.80E-01
CHROMIUM	5.98E-02	2.47E-03	2.61E-02	4.43E-03	3.56E-01	1.47E-02	5.17E-01	8.78E-02
COPPER	2.09E-01	1.42E-02	9.64E-02	1.12E-02	7.43E-01	5.03E-02	1.55E+00	1.80E-01
LEAD	1.47E-01	3.71E-03	2.40E-01	8.77E-03	1.15E+00	2.90E-02	5.34E+00	1.95E-01
THALLIUM	2.84E+00	2.84E-01	#VALUE!	#VALUE!	2.84E+00	2.84E-01	#VALUE!	#VALUE!
VANADIUM	1.77E-02	7.78E-03	2.09E-01	4.23E-02	5.36E-02	2.36E-02	1.84E+00	3.72E-01
ZINC	6.49E-02	1.64E-02	1.98E-02	7.64E-03	4.40E-01	1.11E-01	6.92E-01	2.68E-01

-cells are shade if the EEQ > 1.0
EEQ = Ecological Effects Quotient
#VALUE! = Value not able to be calculated

TABLE 7-11

TERRESTRIAL WILDLIFE MODEL NOAEL AND LOAEL EEQS-CONSERVATIVE EXPOSURE ASSUMPTIONS - CENTRAL ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical	Meadow Vole		Bobwhite Quail		Short-Tailed Shrew		American Woodcock	
	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ
Semivolatile Organics								
BENZO(A)ANTHRACENE	7.70E-02	1.23E-03	1.66E-02	1.66E-03	2.89E+00	4.64E-02	1.03E+00	1.03E-01
BENZO(A)PYRENE	2.35E-01	3.76E-03	3.20E-02	3.20E-03	3.66E+00	5.87E-02	1.31E+00	1.31E-01
BENZO(B)FLUORANTHENE	7.79E-01	1.25E-02	8.18E-02	8.18E-03	5.43E+00	8.69E-02	1.94E+00	1.94E-01
BENZO(G,H,I)PERYLENE	2.81E-01	4.50E-03	2.72E-02	2.72E-03	1.31E+00	2.10E-02	4.69E-01	4.69E-02
BENZO(K)FLUORANTHENE	1.11E-01	1.79E-03	1.66E-02	1.66E-03	2.13E+00	3.40E-02	7.60E-01	7.60E-02
CHRYSENE	8.65E-02	1.39E-03	1.89E-02	1.89E-03	3.35E+00	5.36E-02	1.20E+00	1.20E-01
INDENO(1,2,3-CD)PYRENE	7.82E-02	1.25E-03	1.10E-02	1.10E-03	1.31E+00	2.10E-02	4.69E-01	4.69E-02
PYRENE	2.00E+00	3.20E-02	1.83E-01	1.83E-02	6.33E+00	1.01E-01	2.26E+00	2.26E-01
Inorganics								
ANTIMONY	7.98E-02	1.71E-03	#VALUE!	#VALUE!	2.76E+00	5.90E-02	#VALUE!	#VALUE!
CADMIUM	1.22E-01	1.36E-02	1.98E-02	4.57E-03	2.44E+00	2.72E-01	1.40E+00	3.23E-01
LEAD, LABEQV	1.66E-01	4.18E-03	3.22E-01	1.18E-02	1.30E+00	3.27E-02	5.51E+00	2.01E-01
VANADIUM	3.94E-02	1.74E-02	4.84E-01	9.79E-02	1.12E-01	4.94E-02	4.17E+00	8.43E-01
ZINC	7.83E-02	1.98E-02	2.64E-02	1.02E-02	7.60E-01	1.92E-01	9.56E-01	3.69E-01

-cells are shade if the EEQ > 1.0
EEQ = Ecological Effects Quotient
#VALUE! = Value not able to be calculated

TABLE 7-12

TERRESTRIAL WILDLIFE MODEL NOAEL AND LOAEL EEQS-LESS CONSERVATIVE EXPOSURE ASSUMPTIONS - CENTRAL ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical	Meadow Vole		Bobwhite Quail		Short-Tailed Shrew		American Woodcock	
	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ
Semivolatile Organics								
BENZO(A)ANTHRACENE	1.05E-02	1.68E-04	1.27E-03	1.27E-04	7.55E-02	1.21E-03	3.45E-02	3.45E-03
BENZO(A)PYRENE	2.18E-02	3.50E-04	2.27E-03	2.27E-04	9.71E-02	1.55E-03	4.44E-02	4.44E-03
BENZO(B)FLUORANTHENE	7.66E-02	1.23E-03	6.79E-03	6.79E-04	1.47E-01	2.36E-03	6.73E-02	6.73E-03
BENZO(G,H,I)PERYLENE	2.00E-02	3.20E-04	1.76E-03	1.76E-04	3.63E-02	5.81E-04	1.66E-02	1.66E-03
BENZO(K)FLUORANTHENE	1.23E-02	1.97E-04	1.29E-03	1.29E-04	5.55E-02	8.90E-04	2.54E-02	2.54E-03
CHRYSENE	1.16E-02	1.86E-04	1.43E-03	1.43E-04	8.83E-02	1.41E-03	4.03E-02	4.03E-03
INDENO(1,2,3-CD)PYRENE	7.05E-03	1.13E-04	7.61E-04	7.61E-05	3.58E-02	5.73E-04	1.64E-02	1.64E-03
PYRENE	1.92E-01	3.08E-03	1.58E-02	1.58E-03	1.63E-01	2.60E-03	7.43E-02	7.43E-03
Inorganics								
ANTIMONY	2.14E-02	4.57E-04	#VALUE!	#VALUE!	9.75E-01	2.08E-02	#VALUE!	#VALUE!
CADMIUM	8.33E-02	9.30E-03	1.18E-02	2.73E-03	1.11E+00	1.24E-01	8.01E-01	1.85E-01
LEAD, LABEQV	3.88E-02	9.79E-04	4.58E-02	1.67E-03	2.23E-01	5.62E-03	9.86E-01	3.60E-02
VANADIUM	1.19E-02	5.27E-03	1.41E-01	2.86E-02	3.62E-02	1.60E-02	1.24E+00	2.52E-01
ZINC	5.70E-02	1.44E-02	1.72E-02	6.66E-03	4.08E-01	1.03E-01	6.40E-01	2.48E-01

-cells are shade if the EEQ > 1.0
EEQ = Ecological Effects Quotient
#VALUE! = Value not able to be calculated

TABLE 7-13

TERRESTRIAL WILDLIFE MODEL NOAEL AND LOAEL EEQS-CONSERVATIVE EXPOSURE ASSUMPTIONS - SOUTHERN ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical	Meadow Vole		Bobwhite Quail		Short-Tailed Shrew		American Woodcock	
	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ
Inorganics								
ANTIMONY	5.86E-01	5.86E-02	#VALUE!	#VALUE!	3.29E+01	7.04E-01	#VALUE!	#VALUE!
CADMIUM	1.38E-01	1.54E-02	2.28E-02	5.28E-03	2.92E+00	3.25E-01	1.67E+00	3.87E-01
CHROMIUM	2.36E-01	9.75E-03	1.37E-01	2.33E-02	1.58E+00	6.54E-02	2.15E+00	3.66E-01
COPPER	7.27E-01	4.92E-02	6.04E-01	7.02E-02	7.06E+00	4.78E-01	1.31E+01	1.52E+00
LEAD	6.51E-01	1.64E-02	1.56E+00	5.69E-02	5.22E+00	1.32E-01	2.43E+01	8.86E-01
NICKEL	2.49E-01	2.87E-02	4.08E-02	1.47E-02	2.39E+01	2.75E+00	6.69E+00	2.42E+00
SELENIUM	3.50E-01	7.58E-02	5.40E-02	1.91E-02	9.74E-01	2.11E-01	5.84E-01	2.07E-01
VANADIUM	4.79E-02	2.11E-02	5.88E-01	1.19E-01	1.36E-01	6.00E-02	5.06E+00	1.02E+00
ZINC	1.26E-01	3.20E-02	4.48E-02	1.73E-02	1.00E+00	2.54E-01	1.28E+00	4.97E-01

-cells are shade if the EEQ > 1.0
EEQ = Ecological Effects Quotient
#VALUE! = Value not able to be calculated

TABLE 7-14

TERRESTRIAL WILDLIFE MODEL NOAEL AND LOAEL EEQS-LESS CONSERVATIVE EXPOSURE ASSUMPTIONS - SOUTHERN ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical	Meadow Vole		Bobwhite Quail		Short-Tailed Shrew		American Woodcock	
	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ	NOAEL EEQ	LOAEL EEQ
Inorganics								
ANTIMONY	1.40E-01	3.00E-03	#VALUE!	#VALUE!	6.39E+00	1.37E-01	#VALUE!	#VALUE!
CADMIUM	8.42E-02	9.39E-03	1.20E-02	2.76E-03	1.13E+00	1.26E-01	8.13E-01	1.88E-01
CHROMIUM	6.18E-02	2.55E-03	2.69E-02	4.58E-03	3.68E-01	1.52E-02	5.33E-01	9.07E-02
COPPER	2.11E-01	1.43E-02	9.75E-02	1.13E-02	7.58E-01	5.14E-02	1.58E+00	1.84E-01
LEAD	7.88E-02	1.99E-03	1.10E-01	4.02E-03	5.44E-01	1.37E-02	2.47E+00	9.01E-02
NICKEL	9.14E-02	1.05E-02	1.06E-02	3.83E-03	1.65E+00	1.90E-01	6.01E-01	2.17E-01
SELENIUM	2.13E-01	4.61E-02	2.88E-02	1.02E-02	4.55E-01	9.85E-02	3.22E-01	1.14E-01
VANADIUM	1.27E-02	5.62E-03	1.51E-01	3.05E-02	3.87E-02	1.70E-02	1.33E+00	2.68E-01
ZINC	7.66E-02	1.94E-02	2.35E-02	9.08E-03	4.85E-01	1.23E-01	7.64E-01	2.95E-01

-cells are shade if the EEQ > 1.0
EEQ = Ecological Effects Quotient
#VALUE! = Value not able to be calculated

TABLE 7-15

STEP 3A EVALUATION FOR RISKS TO TERRESTRIAL WILDLIFE
SURFACE SOIL COPCS - NORTHERN ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical of Potential Concern (COPC)	Frequency of Detection[1]	Maximum Detected Concentration (mg/kg)[1]	EEQs Using Average Concentrations and Average Exposure Parameters: NOAEL[2] EEQ > 1.0	NOAEL[2] Species	LOAEL[2] EEQ > 1.0	LOAEL[2] Species	Basis of Wildlife Toxicity Reference Value	Other Step 3a Factors Considered in Evaluation[3]	Risk Determination (Acceptable/ Unacceptable)	Retained as a COPC?
Herbivorous Wildlife										
Thallium	17/18	0.525	2.8	Vole	None	NA	Reduced sperm motility in rats given 10 mg/L thallium sulfate orally in water. Only one dose level was given.	- Thallium is not considered an important bioaccumulative chemical; a default BAF of 1.0 was used for food-chain model calculations,which is highly conservative; dose in the TRV was based on a more bioavailable form of thallium than occurs in UXO 7 soils.	Acceptable	No
Vermivorous Wildlife										
Antimony	16/18	96.2	19.6	Shrew	None	NA	The TRV for mammals (0.059 mg/kg bw/day) was developed using the the highest bounded NOAEL below the lowest bounded LOAEL of the geometric mean of 82 NOAEL values based on growth and reproduction in 145 studies.	- Antimony is not considered an important bioaccumulative chemical; the form of antimony (bullets) is not very bioavailable; an earthworm BAF was not available, so a default value of 1.0 was used to estimate chemical concentrations in earthworms for the vermivorous receptor food-chain models, which leads to an over estimation of the dose ingested in food items; the LOAEL EEQ (0.42) is much lower than 1.0.	Acceptable	No
Cadmium	18/18	2.21	1.08	Shrew	None	NA	The TRV for mammals (0.770 mg/kg bw/day) was developed using the the highest bounded NOAEL below the lowest bounded LOAEL of the geometric mean of 82 NOAEL values based on growth and reproduction in 145 studies.	- NOAEL based EEQ is only slightly greater than 1.0.	Acceptable	No
Copper	18/18	283	1.55	Woodcock	None	NA	The TRV for birds (4.05 mg/kg bw/day) was developed using the the highest bounded NOAEL below the lowest bounded LOAEL of the geometric mean of 79 NOAEL values based on growth and reproduction in 107 studies.	- NOAEL based EEQ is only slightly greater than 1.0.	Acceptable	No
Lead	31/34	1160	1.15	Shrew	None	NA	The TRV for mammals (0.770 mg/kg bw/day) was developed using the the highest bounded NOAEL below the lowest bounded LOAEL of the geometric mean of 95 NOAEL values based on growth and reproduction in 219 studies.	- NOAEL based EEQ is only slightly greater than 1.0.	Acceptable	No
			5.34	Woodcock	None	NA	The TRV for birds (1.63 mg/kg bw/day) was developed using the the highest bounded NOAEL below the lowest bounded LOAEL of the geometric mean of 26 NOAEL values based on growth and reproduction in 54 studies.	- NOAEL based EEQ is much greater than 1.0; lead is the chemical of primary concern at UXO 7.	Unacceptable	Yes
Thallium	17/18	0.525	2.84	Shrew	None	NA	Reduced sperm motility in rats given 10 mg/L thallium sulfate orally in water. Only one dose level was given.	- NOAEL based EEQ is only slightly greater than 1.0; thallium is not considered an important bioaccumulative chemical; a default BAF of 1.0 was used for food-chain model calculations,which is highly conservative; dose in the TRV was based on a more bioavailable form of thallium than occurs in UXO 7 soils.	Acceptable	No
Vanadium	18/18	85.9	1.84	Woodcock	None	NA	The TRV for birds (0.344 mg/kg bw/day) was developed using the the highest bounded NOAEL below the lowest bounded LOAEL of the geometric mean of 32 NOAEL values based on growth and reproduction in 36 studies.	- NOAEL based EEQ is only slightly greater than 1.0.	Acceptable	No

Footnotes:
1 - These columns present the Frequency of Detection and maximum concentrations for chemicals detected in the BDA surface soil samples.
2 - The maximum NOAEL and LOAEL-based EEQs are shown; see Tables 7-9 and 7-10 for all EEQs greater than 1.0.
3 - See Section 7.4.2.2 for a more detailed Step 3a evaluation.

EEQ - Ecological Effects Quotient
NA - Not available or not applicable
NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level

TABLE 7-16

STEP 3A EVALUATION FOR RISKS TO TERRESTRIAL WILDLIFE
SURFACE SOIL COPCS - CENTRAL ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical of Potential Concern (COPC)	Frequency of Detection[1]	Maximum Detected Concentration (mg/kg)[1]	EEQs Using Average Concentrations and Average Exposure Parameters				Basis of Wildlife Toxicity Reference Value	Other Step 3a Factors Considered in Evaluation[3]	Risk Determination (Acceptable/ Unacceptable)	Retained as a COPC?
			NOAEL[2]		LOAEL[2]					
			EEQ > 1.0	Species	EEQ > 1.0	Species				
Vermivorous Wildlife										
Cadmium	3/3	1.43	1.11	Shrew	None	NA	The TRV for mammals (0.770 mg/kg bw/day) was developed using the the highest bounded NOAEL below the lowest bounded LOAEL of the geometric mean of 82 NOAEL values based on growth and reproduction in 145 studies.	- NOAEL based EEQ is only slightly greater than 1.0.	Acceptable	No
Vanadium	3/3	38.10	1.24	Woodcock	None	NA	The TRV for birds (0.344 mg/kg bw/day) was developed using the the highest bounded NOAEL below the lowest bounded LOAEL of the geometric mean of 32 NOAEL values based on growth and reproduction in 36 studies.	- NOAEL based EEQ is only slightly greater than 1.0.	Acceptable	No

Footnotes:
1 - These columns present the Frequency of Detection and maximum concentrations for chemicals detected in the Central Zone surface soil samples.
2 - The maximum NOAEL and LOAEL-based EEQs are shown; see Tables 7-11 and 7-12 for all EEQs greater than 1.0.
3 - See Section 7.4.2.2 for a more detailed Step 3a evaluation.

EEQ - Ecological Effects Quotient
NA - Not available or not applicable
NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level

TABLE 7-17

STEP 3A EVALUATION FOR RISKS TO TERRESTRIAL WILDLIFE
SURFACE SOIL COPCS - SOUTHERN ZONE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemical of Potential Concern (COPC)	Frequency of Detection[1]	Maximum Detected Concentration (mg/kg)[1]	EEQs Using Average Concentrations and Average Exposure Parameters				Basis of Wildlife Toxicity Reference Value	Other Step 3a Factors Considered in Evaluation[3]	Risk Determination (Acceptable/ Unacceptable)	Retained as a COPC?
			NOAEL[2]		LOAEL[2]					
			EEQ > 1.0	Species	EEQ > 1.0	Species				
Vermivorous Wildlife										
Antimony	7/8	11.1	7.2	Shrew	None	NA	The TRV for mammals (0.059 mg/kg bw/day) was developed using the the highest bounded NOAEL below the lowest bounded LOAEL of the geometric mean of 82 NOAEL values based on growth and reproduction in 145 studies.	- Antimony is not considered an important bioaccumulative chemical; the form of antimony (bullets) is not very bioavailable; an earthworm BAF was not available, so a default value of 1.0 was used to estimate chemical concentrations in earthworms for the vermivorous receptor food-chain models, which leads to an over estimation of the dose ingested in food items.; the LOAEL EEQ (0.14) is much lower than 1.0.	Acceptable	No
Cadmium	8/8	1.8	1.13	Shrew	None	NA	The TRV for mammals (0.770 mg/kg bw/day) was developed using the the highest bounded NOAEL below the lowest bounded LOAEL of the geometric mean of 82 NOAEL values based on growth and reproduction in 145 studies.	- NOAEL based EEQ is only slightly greater than 1.0.	Acceptable	No
Copper	8/8	427.0	1.58	Woodcock	None	NA	The TRV for birds (4.05 mg/kg bw/day) was developed using the the highest bounded NOAEL below the lowest bounded LOAEL of the geometric mean of 79 NOAEL values based on growth and reproduction in 107 studies.	- NOAEL based EEQ is only slightly greater than 1.0.	Acceptable	No
Lead	46/50	537.0	2.48	Woodcock	None	NA	The TRV for birds (1.63 mg/kg bw/day) was developed using the the highest bounded NOAEL below the lowest bounded LOAEL of the geometric mean of 26 NOAEL values based on growth and reproduction in 54 studies.	- NOAEL based EEQ is only slightly greater than 1.0.	Acceptable	No
Nickel	8/8	50.2	1.65	Shrew	None	NA	The TRV for mammals (1.70 mg/kg bw/day) was developed using the the highest bounded NOAEL below the lowest bounded LOAEL of the geometric mean of 38 NOAEL values based on growth and reproduction in 52 studies.	- NOAEL based EEQ is only slightly greater than 1.0.	Acceptable	No
Vanadium	8/8	46.3	1.33	Woodcock	None	NA	The TRV for birds (0.344 mg/kg bw/day) was developed using the the highest bounded NOAEL below the lowest bounded LOAEL of the geometric mean of 32 NOAEL values based on growth and reproduction in 36 studies.	- NOAEL based EEQ is only slightly greater than 1.0.	Acceptable	No

Footnotes:
1 - These columns present the Frequency of Detection and maximum concentrations for chemicals detected in the BDA surface soil samples.
2 - The maximum NOAEL and LOAEL-based EEQs are shown; see Tables 7-13 and 7-14 for all EEQs greater than 1.0.
3 - See Section 7.4.2.2 for a more detailed Step 3a evaluation.

EEQ - Ecological Effects Quotient
NA - Not available or not applicable
NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level

FIGURE 7-1
NAVY ECOLOGICAL RISK ASSESSMENT TIERED APPROACH
UXO 7 – OLD RIFLE RANGE
NSWC CRANE
CRANE, INDIANA

RPM Input and Risk Management Consideration (3)

Step 8: Risk Management

Tier 1. Screening Risk Assessment (SRA): Identify pathways and compare exposure point concentrations to benchmarks.
Step 1: Site visit; Pathway Identification/Problem Formulation; Toxicity Evaluation
Step 2: Exposure Estimate; Risk Calculation (SMDP)(1)
Proceed to Exit Criteria for SRA

Exit Criteria for the Screening Risk Assessment (SRA): Decision for exiting or continuing the ecological risk assessment.
1) Site passes SRA. A determination is made that the site poses acceptable risk and shall be closed out for ecological concerns.
2) Site fails SRA: The site must have both complete pathway and unacceptable risk. As a result the site will either have an interim cleanup or moves to the Tier 2.

Tier 2. Baseline Ecological Risk Assessment (BERA):
Detailed assessment of exposure and hazard to "assessment endpoints" (ecological qualities to be protected). Develop site-specific values that are protective of the environment.
Step 3a: Refinement of Conservative Exposure Assumptions(2) (SRA)----**Proceed to Exit Criteria for Step 3a**

Step 3b: Problem Formulation - Toxicity Evaluation; Assessment Endpoints; Conceptual Model; Risk Hypothesis (SMDP)
Step 4: Study Design/DQO - Line of Evidence; Measurement Endpoints; Work Plan and Sampling & Analysis Plan (SMDP)
Step 5: Verification of Field Sampling Design (SMDP)
Step 6: Site Investigation and Data Analysis (SMDP)
Step 7: Risk Characterization
Proceed to Exit Criteria for BERA

Exit Criteria Step 3a Refinement
1) If re-evaluation of the conservative exposure assumptions (SRA) supports an acceptable risk determination, then the site exits the ecological risk assessment process.
2) If re-evaluation of the conservative exposure assumptions (SRA) does not support an acceptable risk determination, then the site continues in the BERA process. **Proceed to Step 3b.**

Exit Criteria Baseline Risk Assessment
1) If the site poses acceptable risk, then no further evaluation and no remediation from an ecological perspective is warranted.
2) If the site poses unacceptable ecological risk and additional evaluation in the form of remedy development and evaluation is appropriate, proceed to Tier 3.

Tier 3. Evaluation of Remedial Alternative (RAGS C)
A. Develop site-specific, risk-based cleanup values.
B. Qualitatively evaluate risk posed to the environment by implementation of each alternative (short-term) impacts and estimate risk reduction provided by each (long-term) impacts; provide quantitative evaluation where appropriate. Weigh alternative using the remaining CERCLA 9 Evaluation Criteria. Plan for monitoring and site closeout.

Notes:
1 See U.S. EPA's 8 Steps ERA Process for requirements for each Scientific Management Decision Point (SMDP).
2 Refinement Includes but is not limited to background, bioavailability, detection frequency, etc.
3 Risk management is incorporated throughout the tiered approach.

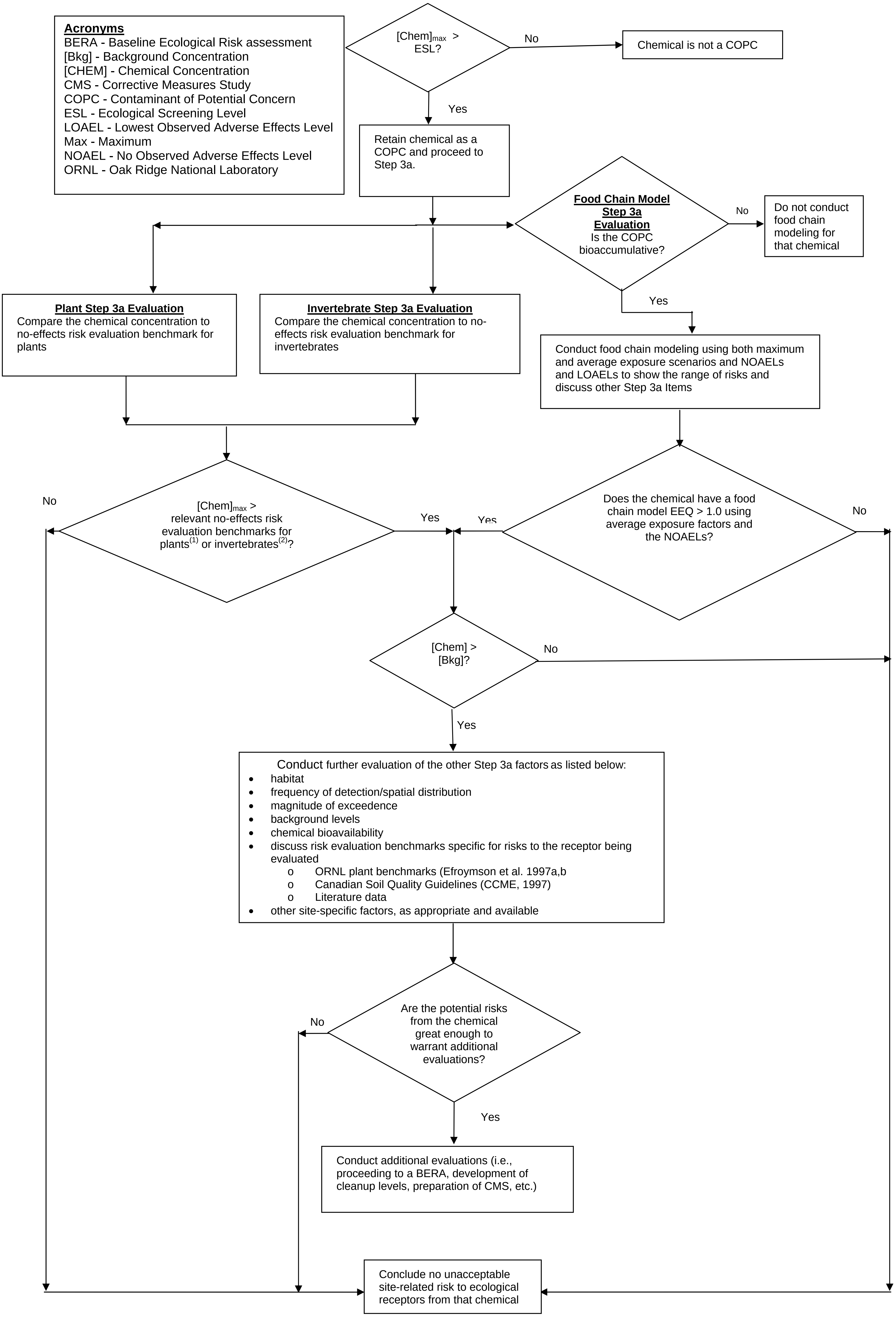
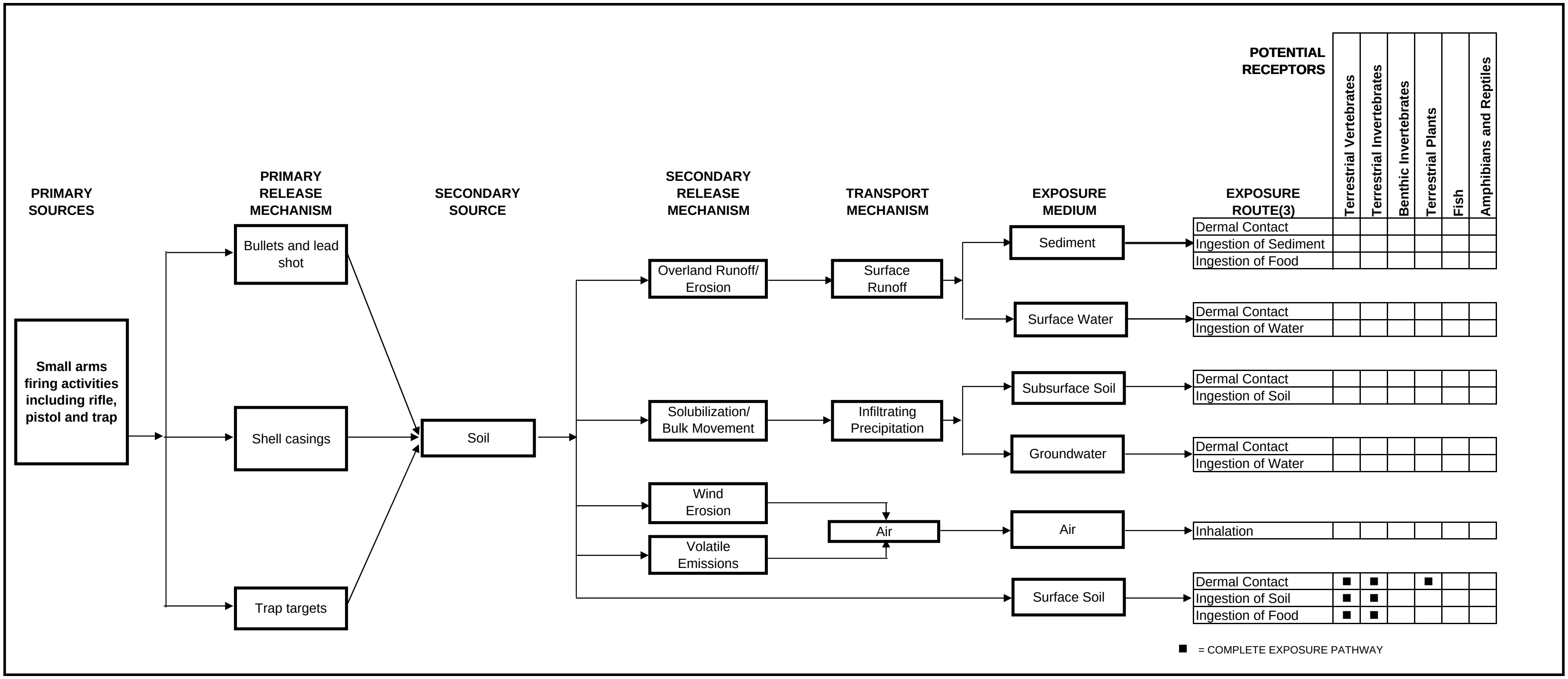


FIGURE 7-2

GENERAL ERA PROCESS FOR EVALUATION OF RISKS TO CHEMICALS IN SURFACE SOIL AT NSWC CRANE, INDIANA
UXO 7 – OLD RIFLE RANGE
NSWC CRANE, CRANE, INDIANA



Blank space indicates incomplete exposure pathway or relatively insignificant or not applicable potential exposure.

FIGURE 7-3

ECOLOGICAL CONCEPTUAL SITE MODEL
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

8.0 CONCLUSIONS AND RECOMMENDATIONS

For purposes of discussion, this RFI report reviews potential soil contamination detected in samples collected from UXO 7. Because the lead concentrations varied significantly across the site, the UXO 7 former small arms ranges were grouped into three exposure units (northern zone, central zone, and southern zone) to evaluate the risks for lead, as presented in Section 7.0. The exposure zones are indicated on Figure 4-1 along with the locations of the 189 surface soil samples collected for field-based XRF analysis. A subset of those 189 soil samples were selected for laboratory analysis. Those soil samples with contaminant concentrations above human health or ecological screening levels are summarized and presented on Figure 4-2 (inorganics) and on Figure 4-3 (PAHs).

The human health risk evaluation estimates developed for construction workers, maintenance workers, occupational workers, adolescent trespassers, child and adult recreational users, and child and adult future residents hypothetically exposed to surface soils within any of the three zones at UXO 7 do not exceed the U.S. EPA benchmarks typically used to determine the need for environmental remediation. PAH concentrations in the Central Zone at sample locations X7SB121 and S7SB123 were found to pose unacceptable risks to the future adult/child resident.

The ecological risk evaluation for terrestrial plants and invertebrates, and mammals and birds determined risk to be acceptable in the Central and Southern Zones. Ecological risk to mammals and birds was found to be unacceptable due to lead concentrations at certain locations within the Northern Zone. The Navy requests no further action for the southern zone of UXO 7. The Navy recommends spot removal of soils within the area of sample locations X7SS0390002, X7SS0460002, X7SS0550002, and X7SS1740002 (Northern Zone) where lead concentrations exceeded 400 mg/kg and spot removal of soil in the area of sample locations X7SS1210002 and X7SS1230002 (Central Zone) where PAH concentrations were found to be unacceptable.

REFERENCES

Army, 1978. Installation Assessment of the NSWC Crane, Record of Evaluation Report No. 117. Aberdeen Proving Ground, Maryland, March.

Comarco Systems, Inc., 2000. Endangered Species Management Plan for the Crane Division, Naval Surface Warfare Center. October.

CCME, 2006. Recommended Canadian Soil Quality Guidelines. Canadian Council of Ministers of the Environment. Ottawa, Ontario. November.

EC (Environment Canada). 1999a. Canadian Soil Quality Guidelines for Chromium. Scientific Supporting Document. National Guidelines and Standards Office, Environmental Quality Branch, Environment Canada. Ottawa.

EC (Environment Canada). 1999b. Canadian Soil Quality Guidelines for Thallium. Scientific Supporting Document. National Guidelines and Standards Office, Environmental Quality Branch, Environment Canada. Ottawa.

EC (Environment Canada). 1999c. Canadian Soil Quality Guidelines for Benzo(a)pyrene. Scientific Supporting Document. National Guidelines and Standards Office, Environmental Quality Branch, Environment Canada. August.

EC (Environment Canada). 2001. Canadian Soil Quality Guidelines for Vanadium. Scientific Supporting Document. National Guidelines and Standards Office, Environmental Quality Branch, Environment Canada. Ottawa.

Eisler, R. 2000. Handbook of Chemical Risk Assessment: Health Hazards to Humans, Plants, and Animals; Volume 1, Metals. Lewis Publishers, Boca Raton, FL.

Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten, 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. ES/ER/TM-85/R3. Oak Ridge National Laboratory, November.

Halliburton NUS, 1992a. RFI Phase I, Environmental Monitoring Report, SWMUs 19/00, 08/17. 12/14, 13/14. Navy Northern Division, CTO 15, August.

Halliburton NUS, 1992b. RFI Phase I, Environmental Monitoring Report, SWMUs 15/06, 14/10, 16/16, NorthDiv, CTO 15, November.

IDEM, January 2006. Risk Integrated System of Closure Users Guide and Technical Resource Guidance Document. Indiana Department of Environmental Management, February 2001, Updated January 2006.

Indiana Department of Natural Resources (IDNR), 2000. Nongame and Endangered Wildlife Program, Annual Report September 1999 - August 2000. Division of Fish and Wildlife.

Indiana Department of Natural Resources (IDNR), 2004. Nongame and Endangered Wildlife Program, Annual Report September 2003 – August 2004. Division of Fish and Wildlife.

Navy, 1999. Navy Policy For Conducting Ecological Risk Assessments. Memo from Chief of Naval Operations to Commander, Naval Facilities Engineering Command. Department of the Navy, Washington, DC, April 5.

Navy, February 2001. Conductivity Human Health Risk Assessments under the Environmental Restoration Program. SER N453E/1U595168. Washington, D.C.

Navy, January 2004. Navy Policy on the Use of Chemical Background Levels, SER N45C/N4U732212, Washington, D.C., 2004.

NEESA (Naval Energy and Environmental Support Activity), 1983. Initial Assessment Study of Naval Weapons Support Center, Crane, Indiana. NEESA 13-003, May.

ORNL (Oak Ridge National Laboratory). 1998. Empirical Model for the Uptake of Inorganic Chemicals from Soil by Plants. BJC/OR-133. September.

ORNL. 2008. Toxicity and Chemical-Specific Factors Database. Oak Ridge National Laboratory Web Page, http://rais.ornl.gov/cgi-bin/tox/TOX_select?select=csf

Sample, B.E., D.M. Opresko, and G.W. Suter II (Sample, et. al.), 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. ES/ER/TM-86/R3. Oak Ridge National Laboratory, June.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W., Suter II, and T.L. Ashwood. 1998. Development and Validation of Bioaccumulation Models for Earthworms. Oak Ridge National Laboratory. February. ES/ER/TM-220.

Sample, B. E. and C. A. Arenal. 1999. Allometric models for interspecies extrapolation of wildlife toxicity data. Bull. Environ. Contam. Toxicol. 62:653-663.

Smith, Robert L., 1966. Ecology and Field Biology. Harper and Row, Publishers, Inc.

TtNUS, 1999. Current Conditions Risk Assessment NSWC Crane SWMUs 03/10, 07/09, 06/09. February.

TtNUs, January 2001. Final Basewide Background Soil Investigation Report, Naval Surface Warfare Center Crane, Crane, Indiana.

TtNUS, April 2003. Resource Conservation And Recovery Act Facility Investigation Report For SWMUs 4 (McComish Gorge), 5 (Old Burn Pit), 9 (Pesticide Control/R-150 Tank Area), And 10 (Rockeye), Naval Surface Warfare Center Crane Division, Crane, Indiana

TtNUS, October 2003. Resource Conservation And Recovery Act Facility Investigation Report For SWMU 03 - Old Jeep Trail/Little Sulphur Creek, Naval Surface Warfare Center Crane Division, Crane, Indiana.

TtNUS, September 2004a. Quality Assurance Project Plan for RCRA Facility Investigation at Building 106 Pond (SWMU 8) Roads and Grounds Area (SWMU 15) and Environmental Indicator Investigation for SWMU 18 (Load and Fill Area Buildings), SWMU 19 (Pyrotechnic Test Area), SWMU 20 (Crane Army Ammunition Activity Quality Assurance/Quality Control Test Area), and the Old Gun Tub Storage Lot. NSWC Crane, Crane, Indiana.

TtNUS. September 2004b. Quality Assurance Project Plan for RCRA Facility Investigation at Building 106 Pond (SWMU 8) Roads and Grounds Area (SWMU 15) AND Environmental Indicator Investigation for SWMU 18 (Load and Fill Area Buildings), SWMU 19 (Pyrotechnic Test Area), SWMU 20 (Crane Army Ammunition Activity Quality Assurance/Quality Control Test Area), and the Old Gun Tub Storage Lot.

TtNUS, June 2005. Resource Conservation and Recovery Act Facility Investigation Report for Cast High Explosivs Fill/B146 Incinerator (SWMU 16), Naval Surface Warfare Center Crane Division, Crane Indiana.

TtNUS, July 2005. Resource Conservation and Recovery Act Facility Investigation Report for Mine Fill B (SWMU 13), Naval Surface Warfare Center Crane Division, Crane Indiana.

TtNUS, September 2005. Phase III Soils Report RCRA Facility Investigation Solid Waste Management Unit 7 (Old Rifle Range), Naval Surface Warfare Center Crane Division, Crane Indiana.

TtNUS, January 2006. Resource Conservation And Recovery Act Facility Investigation Report for SWMU 12 – Mine Fill A, Naval Surface Warfare Center Crane Division, Crane, Indiana.

TtNUS, 2007a. RCRA Facility Investigation Report Mine Fill B (SWMU 13). April.

TtNUS, 2007b. RCRA Addendum No. 2 to the QAPP for SWMUs 8, 15, 18, 19, 20 and the Old Gun Tub Storage Lot for UXO 5 and UXO 7. August.

TtNUS, 2007. Resource Conservation and Recovery Act Addendum No. 2 to the Quality Assurance Project Plan for SWMUs 8, 15, 18, 19, 20, and the Old Gun Tub Storage Lot for UXO 5 (Building 2044 Drop Tower/Test Rail Site) and UXO 7 (Ranges). August.

TtNUS, September 2007. Interim Measures Report for SWMU 7 - Old Rifle Range, Old Pistol Range Site, Naval Surface Warfare Center Crane, Crane, Indiana.

U.S. EPA (United States Environmental Protection Agency), December 1989. Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part A). EPA 540/1-89/002. Office of Emergency and Remedial Response, Washington, D.C.

U.S. EPA, March 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. Directive 9285.6 03, Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. EPA, December 1991. Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals). Publication 9285.7-01B. Office of Emergency and Remedial Response, Washington, DC. NTIS PB92-963333.

U.S. EPA, February 1992. Memorandum: Guidance on Risk Characterization for Risk Managers and Risk Assessors. Henry Habicht II, Deputy Administrator, Washington, DC.

U.S. EPA, May 1993a. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. Office of Solid Waste and Emergency Response, Washington.

U.S. EPA, July 1993a. Provisional Guidance for Quantitative Risk Assessment for Polycyclic Aromatic Hydrocarbons. Office of Research and Development. Washington, D.C. EPA/600/R-93-089.

U.S. EPA, 1993b. Wildlife Exposure Factors Handbook. EPA/600/R-93/187a. Office of Research and Development. Washington, DC, 1993.

U.S. EPA, July 1994. Guidance on Residential Lead-Based Paint, Lead-Contaminated Dust, and Lead-Contaminated Soil. Office of Prevention, Pesticides, and Toxic Substances, Washington, D.C.

U.S. EPA, July 1994. Revised Interim Guidance on Establishing Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. OSWER Directive 9355.4-12.

U.S. EPA, May 1996. Soil Screening Guidance: Technical Background Document. EPA/540/R-95/128, Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. EPA, July 1997a. Health Effects Assessment Summary Tables FY 1997. Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. EPA, August 1997a. Exposure Factors Handbook. EPA/600/P 95/002Ba, National Center for Environmental Assessment, Washington, D.C.

U.S. EPA, 1997b. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. Interim Final. Environmental Response Team, June 5.

U.S. EPA, 1998. Final Guidelines for Ecological Risk Assessment. Effective April 30.

U.S. EPA, 2000. Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs. Office of Water, Office of Solid Waste. EPA 823-R-00-001. February.

U.S. EPA, December 2001. Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual, Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments. Publication 9285.7-47, Office of Emergency and Remedial Response, Washington, D.C.

U.S. EPA, 2002a. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Solid Waste and Emergency Response 9355.4-24, Washington, D.C., December.

U.S. EPA, April 2002. Role of Background in the CERCLA Cleanup Program, Office of Solid Waste and Emergency Response and Office of Emergency and Remedial Response, OSWER 9285.6-07P.

U.S. EPA, May 2002. User's Guide for the Biokinetic Model for Lead in Children (IEUBK) Windows version. EPA 9285.7-42. Office of Emergency and Remedial Response, Washington, D.C

U.S. EPA, December 2002. Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous OSWER 9285.6-10. Waste Sites. Office of Emergency and Remedial Response, Washington, D.C., December.

U.S. EPA, 2003a. Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. EPA-540-R-03-001. OSWER Directive 9285.7-54. January.

U.S. EPA, 2003b. Ecological Screening Levels. U. S. EPA Region 5 (http://www.epa.gov/reg5rcra/ca/edql.htm). August.

U.S. EPA, November 2003a. Assessing Intermittent or Variable Exposures at Lead Sites, EPA-540-R-03-008. OSWER # 9285.7-76. Office of Solid Waste and Emergency Response, Washington, DC.

U.S. EPA, December 2003a. Human Health Toxicity Values in Superfund Risk Assessments. Office of Superfund Remediation and Technology Innovation, OSWER 9285.7-53, Washington, D.C.

U.S. EPA, July 2004a. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment), Final. EPA/540/R/99/005, Office of Emergency and Remedial Response, Washington, D.C.

U.S. EPA Region 9, October 2004. Preliminary Remediation Goals, Update December 28.

U.S. EPA (U.S. Environmental Protection Agency), 2005a. Ecological Soil Screening Level for Barium, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-63. February.

U.S. EPA, 2005a. Guidance for Developing Ecological Soil Screening Levels. Office of Solid Waste and Emergency and Response. OSWER Directive 92857-55. February.

U.S. EPA, 2005a. Ecological Soil Screening Level for Antimony, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-61. February.

U.S. EPA, 2005a. Ecological Soil Screening Level for Cadmium, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-65. March.

U.S. EPA, 2005a. Ecological Soil Screening Level for Lead, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-70. March.

U.S. EPA, March 2005b. Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens, Risk Assessment Forum, EPA/630/R-03/003F, U.S. Environmental Protection Agency, Washington, DC.

U.S. EPA, March 2005b. Guidelines for Carcinogen Risk Assessment, Risk Assessment Forum, EPA/630/P-03/001F, U.S. Environmental Protection Agency, Washington D.C.

U.S. EPA, 2005a. Ecological Soil Screening Level for Vanadium, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-75. April.

U.S. EPA, 2007a. Ecological Soil Screening Level for Copper, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-68. February.

U.S. EPA, 2007a. Ecological Soil Screening Level for Nickel, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-76. March.

U.S. EPA, April 2007b. ProUCL Version 4.00.02 User Guide. EPA/600/R-07/038. Office of Research and Development, Washington.

U.S. EPA, April 2007b. ProUCL Version 4.0 Technical Guide. EPA/600/R-07/041. Office of Research and Development, Washington, DC.

U.S. EPA, 2007a. Ecological Soil Screening Level for Selenium, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-72. July.

U.S. EPA, 2007a. Ecological Soil Screening Level for Zinc, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-73. June.

U.S. EPA, 2007a. Ecological Soil Screening Level for PAHs, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-78. June.

U.S. EPA, May 2008. U.S. EPA Technical Review Workgroup for Lead. Guidance Document. Frequently Asked Questions (FAQs) on the Adult Lead Model. http://www.epa.gov/superfund/programs/lead/almfaq.htm.

U.S. EPA, 2008. Integrated Risk Information System (IRIS) On-line Data Base. May.

U.S. EPA, 2008. Ecological Soil Screening Level for Chromium, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.

USACE Waterways Experiment State (WES), 1998. Final Report: RCRA Facility Investigation, Phase II Groundwater Release Assessment, SWMU 06/09 Demolition Area and Phase III Release Characterization, SWMU 07/09 Old Rifle Range, Naval Surface Warfare Center Crane, Indiana, Technical Report GP-98-8, Vicksburg, Mississippi, June.

APPENDIX A

FIELD DOCUMENTATION

(Sample Logs, QC Logs, Daily Activity Logs, Chain-of-Custody Forms)

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0010002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB001
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	grey and brn	silt and clay damp
Time:	10:20			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0020002
Sample Location: X7SB002
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	brn	silt tr clay and fg sand damp
Time:	10:45			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0030002
Sample Location: X7SB003
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	Brn	silt tr fg sand and gravel and clay Damp
Time:	10:25			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle If Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0040002
Sample Location: X7SB004
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	med brn	silt and tr clay and fg sand
Time:	11:00			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0050002
Sample Location: X7SB005
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/1/2007	0-2 feet	med brn	silt and clay tr fg sand damp
Time:	10:30			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0060002
Sample Location: X7SB006
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007			
Time:	1055	0-2 feet	yel-brn	silt tr clay, fg sand and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0070002
Sample Location: X7SB007
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007			
Time:	1040	0-2 feet	yel-brn	Silt and tr clay tr f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

Sample ID No.: X7SS0080002
Sample Location: X7SB008
Sampled By: Goerdt/Montez
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	brn	Clay and silt tr fg sand and f-gravel damp
Time:	1512			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0090002
Sample Location: X7SB009
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007			
Time:	1505	0-2 feet	brn	Silt and tr clay tr gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0100002
Sample Location: X7SB010
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	brn	Silt and tr clay tr f-gravel damp
Time:	1440			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0110002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB011
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	brn	Silt and tr clay tr fg sand damp
Time:	1450			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0120002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB012
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	brn	*Silt and tr clay tr fg sand damp*
Time:	1504			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.: X7FD10020701

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0130002
Sample Location: X7SB013
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	brn	Silt and tr clay tr gravel damp
Time:	1452			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0140002
Sample Location: X7SB014
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	brn	Silt and tr clay tr fg sand damp
Time:	1442			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

Sample ID No.: X7SS0150002
Sample Location: X7SB015
Sampled By: Goerdt/Montez
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	drk brn	silt tr clay and fg sand damp
Time:	1420			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

Sample ID No.: X7SS0160002
Sample Location: X7SB016
Sampled By: Goerdt/Montez
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	brn	silt tr clay and fg sand and f-gravel damp
Time:	1430			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0170002
Sample Location: X7SB017
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	yel brn	clay tr silt damp
Time:	1530			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0180002
Sample Location: X7SB018
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007			
Time:	1540	0-2 feet	yel-brn	silt and clay tr fg sand and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0190002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB019
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	brn	Silt and tr clay tr fg sand damp
Time:	1540			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0200002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB020
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/2/2007	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Time:	1533			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0210002
Sample Location: X7SB021
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Time:	800			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle If Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0220002
Sample Location: X7SB022
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007			
Time:	819	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0230002
Sample Location: X7SB023
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Time:	825			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0240002
Sample Location: X7SB024
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Time:	831			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0250002
Sample Location: X7SB025
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Time:	836			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0260002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB026
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Time:	850			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0270002
Sample Location: X7SB027
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Time:	927			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0280002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB028
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007			
Time:	916	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0290002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB029
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Time:	920			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0300002
Sample Location: X7SB030
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007			
Time:	909	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0310002
Sample Location: X7SB031
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Time:	900			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0320002
Sample Location: X7SB032
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Time:	1031			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0330002
Sample Location: X7SB033
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Time:	1026			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

Sample ID No.: X7SS0340002
Sample Location: X7SB034
Sampled By: Goerdt/Montez
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Time:	1018			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0350002
Sample Location: X7SB035
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	yel-brn	silt and clay, tr fg sand and f-gravel damp
Time:	1012			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0360002
Sample Location: X7SB036
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007			
Time:	1006	0-2 feet	yel-brn	clay, tr fg sand silt and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle If Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

Sample ID No.: X7SS0370002
Sample Location: X7SB037
Sampled By: Goerdt/Montez
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	brn	silt, tr fg sand, clay and gravel damp
Time:	1000			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0380002
Sample Location: X7SB038
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007			
Time:	1143	0-2 feet	brn	silt, tr fg sand, clay and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0390002
Sample Location: X7SB039
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	brn	silt, tr fg sand, clay and gravel damp
Time:	1150			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] *Surface Soil*
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0400002
Sample Location: X7SB040
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007			
Time:	1157	0-2 feet	brn	silt, tr fg sand, clay and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0410002
Sample Location: X7SB041
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	brn	clay and silt, tr fg sand and gravel damp
Time:	1132			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0420002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB042
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	brn	clay and silt, tr fg sand and gravel damp
Time:	1139			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0430002
Sample Location: X7SB043
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007			
Time:	1315	0-2 feet	yel-brn	silt, tr fg sand clay and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

Sample ID No.: X7SS0440002
Sample Location: X7SB044
Sampled By: Goerdt/Montez
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	brn	silt, tr fg sand clay and gravel damp
Time:	1320			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0450002
Sample Location: X7SB045
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	brn	silt, tr fg sand clay and gravel damp
Time:	1238			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings				
(Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.: X7FD10030701

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0460002
Sample Location: X7SB046
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	yel-brn	silt, tr fg sand clay and gravel damp
Time:	1244			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0470002
Sample Location: X7SB047
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	yel-brn	silt, tr fg sand clay and gravel damp
Time:	1237			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

Sample ID No.: X7SS0480002
Sample Location: X7SB048
Sampled By: Goerdt/Montez
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007			
Time:	1231	0-2 feet	yel-brn	silt, tr fg sand clay and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0490002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB049
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	brn	silt, tr fg sand clay and gravel damp
Time:	1400			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0500002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB050
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007			
Time:	1404	0-2 feet	brn	silt, tr fg sand clay and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0510002
Sample Location: X7SB051
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007	0-2 feet	brn	silt, tr fg sand clay and gravel damp
Time:	1350			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0520002
Sample Location: X7SB052
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/3/2007			
Time:	1355	0-2 feet	brn	silt, tr fg sand clay and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0530002
Sample Location: X7SB053
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	brn	silt, tr fg sand clay and gravel damp
Time:	947			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0540002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB054
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	brn	silt, tr fg sand clay and gravel damp
Time:	952			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0550002
Sample Location: X7SB055
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	brn	silt, tr fg sand clay and gravel damp
Time:	959			
Method:	Hand Auger			
Monitor Reading (ppm)	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0560002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB056
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	yel-brn	clay and silt, tr fg sand and gravel damp
Time:	1008			
Method:	Hand Auger			
Monitor Reading (ppm)	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0570002
Sample Location: X7SB057
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	yel-brn	clay and silt, tr fg sand and gravel damp
Time:	1012			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0580002
Sample Location: X7SB058
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	brn	silt, tr fg sand, clay and gravel damp
Time:	1018			
Method:	Hand Auger			
Monitor Reading (ppm)	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0590002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB059
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	brn	silt, tr fg sand, clay and gravel damp
Time:	1320			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0600002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB060
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	light brn	clay and silt, tr fg sand, and gravel damp
Time:	1326			
Method:	Hand Auger			
Monitor Reading (ppm)	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0610002
Sample Location: X7SB061
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	brn	silt, tr fg sand, clay and gravel damp
Time:	1336			
Method:	Hand Auger			
Monitor Reading (ppm)	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0620002
Sample Location: X7SB062
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	brn	silt, tr fg sand, clay and gravel damp
Time:	1332			
Method:	Hand Auger			
Monitor Reading (ppm)	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0630002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB063
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	yel-brn	clay and silt, tr fg sand, and gravel damp
Time:	1339			
Method:	Hand Auger			
Monitor Reading (ppm)	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0640002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB064
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007			
Time:	1348	0-2 feet	brn	silt, tr fg sand, clay and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm)	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0650002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB065
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	brn	silt, tr fg sand, clay and gravel damp
Time:	1352			
Method:	Hand Auger			
Monitor Reading (ppm)	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0660002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB066
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	brn	silt, tr fg sand, clay and gravel damp
Time:	1603			
Method:	Hand Auger			
Monitor Reading (ppm)	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0670002
Sample Location: X7SB067
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	yel-brn	clay and silt, tr fg sand, and gravel damp
Time:	1538			
Method:	Hand Auger			
Monitor Reading (ppm)	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0680002
Sample Location: X7SB068
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007	0-2 feet	yel-brn	silt, tr fg sand, clay and gravel damp
Time:	1548			
Method:	Hand Auger			
Monitor Reading (ppm)	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0690002
Sample Location: X7SB069
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	brn	silt, tr fg sand, clay and gravel damp
Time:	849			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0700002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB070
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/9/2007	0-2 feet	yel-brn	silt tr fg sand, clay and gravel damp
Time:	1048			
Method:	Hand Auger			
Monitor Reading (ppm)	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0710002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB071
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	brn	silt, tr fg sand, clay and gravel damp
Time:	854			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD **Duplicate ID No.:**

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0720002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB072
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/4/2007			
Time:	1557	0-2 feet	brn	silt, sand, clay and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm)	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0730002
Sample Location: X7SB073
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	brn	clay tr fg sand, silt, and gravel damp
Time:	1006			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

Sample ID No.: X7SS0740002
Sample Location: X7SB074
Sampled By: Goerdt/Montez
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	brn	silt tr fg sand, clay and gravel damp
Time:	952			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0750002
Sample Location: X7SB075
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	brn	silt tr fg sand, clay and gravel damp
Time:	948			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0760002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB076
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	light brn	silt tr fg sand, clay and gravel damp
Time:	928			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0770002
Sample Location: X7SB077
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	light brn	silt tr fg sand, clay and gravel damp
Time:	932			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0780002
Sample Location: X7SB078
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007			
Time:	918	0-2 feet	light brn	silt tr fg sand, clay and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0790002
Sample Location: X7SB079
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	light brn	silt tr fg sand, clay and gravel damp
Time:	912			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.: X7FD10050701

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0800002
Sample Location: X7SB080
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	yel-brn	silt, tr fg sand, clay and gravel damp
Time:	1002			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0810002
Sample Location: X7SB081
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	light brn	silt tr fg sand, clay and gravel damp
Time:	1423			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0820002
Sample Location: X7SB082
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007			
Time:	1429	0-2 feet	light brn	silt tr fg sand, clay and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0830002
Sample Location: X7SB083
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	light brn	silt tr fg sand, clay and gravel damp
Time:	1437			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0840002
Sample Location: X7SB084
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	brn	silt tr fg sand, clay and gravel damp
Time:	1418			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0850002
Sample Location: X7SB085
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	brn	silt tr fg sand, clay and gravel damp
Time:	1421			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0860002
Sample Location: X7SB086
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	light brn	silt tr fg sand, clay and gravel damp
Time:	1413			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0870002
Sample Location: X7SB087
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	light brn	silt tr fg sand, clay and gravel damp
Time:	1408			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

Signature(s):

MS/MSD	Duplicate ID No.:

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0910002
Sample Location: X7SB091
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007			
Time:	1501	0-2 feet	light brn	silt tr fg sand, clay and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0920002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB092
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	light brn	silt tr fg sand, clay and gravel damp
Time:	1456			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0930002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB093
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	light brn	silt tr fg sand, clay and gravel damp
Time:	1450			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0940002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB094
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/5/2007	0-2 feet	light brn	silt tr fg sand, clay and gravel damp
Time:	1446			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0950002
Sample Location: X7SB095
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

			Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 10/6/2007	Depth Interval			
Time: 1425	0-2 feet		brn	silt tr fg sand, clay and gravel damp
Method: Hand Auger				
Monitor Read NA				

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requireme	Collected	Other
XRF FIELD		PLASTIC BAG	YES	
TAL METALS SW-846-3050B/6020		4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0960002
Sample Location: X7SB096
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, clay and gravel damp
Time:	1431			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS0970002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB097
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt, clay and f-gravel damp
Time:	810			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0980002
Sample Location: X7SB098
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007			
Time:	806	0-2 feet	brn	sand, silt, clay and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS0990002
Sample Location: X7SB099
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, clay and gravel damp
Time:	1357			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1000002
Sample Location: X7SB100
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt and clay tr fg sand, and gravel damp
Time:	1400			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1010002
Sample Location: X7SB101
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, clay and gravel damp
Time:	1418			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1020002
Sample Location: X7SB102
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, clay and gravel damp
Time:	1402			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1030002
Sample Location: X7SB103
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, gravel, and clay damp
Time:	1343			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1040002
Sample Location: X7SB104
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, gravel, and clay damp
Time:	1333			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1050002
Sample Location: X7SB105
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, gravel, and clay damp
Time:	1357			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1060002
Sample Location: X7SB106
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007			
Time:	1351	0-2 feet	brn	silt tr fg sand, gravel, and clay damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1070002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB107
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/9/2007	0-2 feet	brn	silt tr fg sand, clay and gravel damp
Time:	856			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1080002
Sample Location: X7SB108
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/9/2007	0-2 feet	brn	silt tr fg sand, clay and gravel damp
Time:	904			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

Sample ID No.: X7SS1090002
Sample Location: X7SB109
Sampled By: Goerdt/Montez
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/9/2007	0-2 feet	brn	silt tr fg sand, clay and gravel damp
Time:	901			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1100002
Sample Location: X7SB110
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, gravel, and clay damp
Time:	1038			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1110002
Sample Location: X7SB111
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, gravel, and clay damp
Time:	1025			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1120002
Sample Location: X7SB112
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, clay, and gravel damp
Time:	922			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle If Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1130002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB113
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007			
Time:	937	0-2 feet	brn	silt and clay tr fg sand and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1140002
Sample Location: X7SB114
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, clay, and gravel damp
Time:	928			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1150002
Sample Location: X7SB115
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007			
Time:	945	0-2 feet	brn	silt tr fg sand, gravel, and clay damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1160002
Sample Location: X7SB116
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007			
Time:	1019	0-2 feet	brn	silt tr fg sand, gravel, and clay damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1170002
Sample Location: X7SB117
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	yel-brn	silt tr fg sand, gravel, and clay damp
Time:	1014			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1180002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB118
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007			
Time:	1008	0-2 feet	brn	silt tr fg sand, gravel, and clay damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1190002
Sample Location: X7SB119
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt, clay and f-gravel damp
Time:	830			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1200002
Sample Location: X7SB120
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, clay, and gravel damp
Time:	841			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1210002
Sample Location: X7SB121
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, clay, and gravel damp
Time:	857			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1220002
Sample Location: X7SB122
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	yel-brn	clay tr fg sand, silt, and gravel damp
Time:	903			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings				
(Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1230002
Sample Location: X7SB123
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt and clay tr fg sand, and gravel damp
Time:	915			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

Sample ID No.: X7SS1240002
Sample Location: X7SB124
Sampled By: Goerdt/Montez
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, clay, and gravel damp
Time:	808			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1250002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB125
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 10/6/2007	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 802	0-2 feet	yel-brn	clay and silt tr fg sand and gravel damp
Method: Hand Auger			
Monitor Reading (ppm NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1260002
Sample Location: X7SB126
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt, clay and f-gravel damp
Time:	841			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1270002
Sample Location: X7SB127
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt, clay and f-gravel damp
Time:	823			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1280002
Sample Location: X7SB128
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, clay, and gravel damp
Time:	835			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1290002
Sample Location: X7SB129
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	silt tr fg sand, clay, and gravel damp
Time:	820			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1300002
Sample Location: X7SB130
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	yel-brn	clay tr fg sand, silt, and gravel damp
Time:	814			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1320002
Sample Location: X7SB132
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007			
Time:	1115	0-2 feet	brn	silt tr fg sand, clay and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1330002
Sample Location: X7SB133
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	brn	clay and silt tr fg sand and gravel damp
Time:	1057			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1340002
Sample Location: X7SB134
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007			
Time:	1045	0-2 feet	brn	clay and silt tr fg sand and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1350002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB135
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	yel-brn	clay and silt tr fg sand and gravel damp
Time:	1035			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1360002
Sample Location: X7SB136
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007			
Time:	1023	0-2 feet	brn	silt tr fg sand clay and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1370002
Sample Location: X7SB137
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	Yel-brn	silt tr fg sand clay and gravel damp
Time:	1018			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1380002
Sample Location: X7SB138
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	Yel-brn	clay and silt tr fg sand and gravel damp
Time:	1010			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1400002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB140
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	yel-brn	clay and silt tr fg sand, and gravel damp
Time:	1146			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1410002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB141
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/6/2007	0-2 feet	yel-brn	clay and silt tr fg sand, and gravel damp
Time:	1138			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

Sample ID No.: X7SS1420002
Sample Location: X7SB142
Sampled By: Goerdt/Montez
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	silt, tr fg sand, clay and f-gravel damp
Time:	1226			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1430002
Sample Location: X7SB143
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007			
Time:	1138	0-2 feet	brn	silt, tr fg sand, clay and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1440002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB144
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt, clay and f-gravel damp
Time:	1038			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1450002
Sample Location: X7SB145
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007			
Time:	911	0-2 feet	brn	sand, silt, clay and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1460002
Sample Location: X7SB146
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	silt, tr fg sand, clay and f-gravel damp
Time:	1256			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1470002
Sample Location: X7SB147
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007			
Time:	1146	0-2 feet	dk brn	silt, tr fg sand, clay and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1480002
Sample Location: X7SB148
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt, clay and f-gravel damp
Time:	1016			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1490002
Sample Location: X7SB149
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt, clay and f-gravel damp
Time:	904			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1500002
Sample Location: X7SB150
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	silt and clay, tr fg sand and f-gravel damp
Time:	1306			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1510002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB151
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007			
Time:	1157	0-2 feet	yel brn	silt, tr fg sand, clay and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1520002
Sample Location: X7SB152
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt, clay and f-gravel damp
Time:	1002			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1530002
Sample Location: X7SB153
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt, clay and f-gravel damp
Time:	923			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1540002
Sample Location: X7SB154
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	silt, tr fg sand, clay and f-gravel damp
Time:	1316			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1550002
Sample Location: X7SB155
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	silt, tr fg sand, clay and f-gravel damp
Time:	1336			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1560002
Sample Location: X7SB156
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	silt, tr fg sand, clay and f-gravel damp
Time:	1216			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1570002
Sample Location: X7SB157
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt, clay and f-gravel damp
Time:	947			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1580002
Sample Location: X7SB158
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt, clay and f-gravel damp
Time:	930			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1590002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB159
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 10/7/2007	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1408	0-2 feet	yrl-brn	silty clay, tr fg sand and f-gravel damp
Method: Hand Auger			
Monitor Reading (ppm NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1600002
Sample Location: X7SB160
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	yrl-brn	silt and clay, tr fg sand and f-gravel damp
Time:	1418			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1610002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB161
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007			
Time:	1428	0-2 feet	yrl-brn	silt and clay, tr fg sand and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1620002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB162
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	yel brn	clay and silt, tr fg sand, f-gravel damp
Time:	1512			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

Sample ID No.: X7SS1630002
Sample Location: X7SB163
Sampled By: Goerdt/Montez
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	yrl-brn	silt and clay, tr fg sand and f-gravel damp
Time:	1330			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1640002
Sample Location: X7SB164
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007			
Time:	1342	0-2 feet	yrl-brn	silt and clay, tr fg sand and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1650002
Sample Location: X7SB165
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	yrl-brn	silt and clay, tr fg sand and f-gravel damp
Time:	1352			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1660002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB166
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	clay and silt, tr fg sand and f-gravel damp
Time:	1503			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings				
(Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1670002
Sample Location: X7SB167
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007			
Time:	1450	0-1 feet	brn	clay and silt, tr fg sand and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1680002
Sample Location: X7SB168
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-1 feet	yrl-brn	clay and silt, fg sand and f-gravel damp
Time:	1438			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1690002
Sample Location: X7SB169
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007			
Time:	1425	0-1 feet	yrl-brn	clay, tr silt, fg sand and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1700002
Sample Location: X7SB170
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-1 feet	yrl-brn	clay, tr silt, fg sand and f-gravel damp
Time:	1418			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1710002
Sample Location: X7SB171
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007			
Time:	1405	0-2 feet	yrl-brn	clay, tr silt, fg sand and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1730002
Sample Location: X7SB173
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand and f-gravel damp
Time:	1000			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1740002
Sample Location: X7SB174
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007			
Time:	950	0-1 feet	brn	sand and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1750002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB175
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-1 feet	brn	sand and f-gravel damp
Time:	1008			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1760002
Sample Location: X7SB176
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007			
Time:	1018	0-1 feet	brn	sand and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1770002
Sample Location: X7SB177
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt and f-gravel damp
Time:	1036			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1780002
Sample Location: X7SB178
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt and f-gravel damp
Time:	1047			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1790002
Sample Location: X7SB179
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt and f-gravel damp
Time:	1030			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

Sample ID No.: X7SS1800002
Sample Location: X7SB180
Sampled By: Goerdt/Montez
C.O.C. No.:

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt and f-gravel damp
Time:	1055			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1810002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB181
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt and f-gravel damp
Time:	1103			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1820002
Sample Location: X7SB182
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007			
Time:	1112	0-2 feet	brn	sand, silt and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1830002
Sample Location: X7SB183
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007	0-2 feet	brn	sand, silt and f-gravel damp
Time:	1130			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name:	NSWC Crane UXO 5 and 7	Sample ID No.:	X7SS1840002
Project No.:	112G00447 CTO 0034	Sample Location:	X7SB184
		Sampled By:	Goerdt/Montez
		C.O.C. No.:	

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/7/2007			
Time:	1145	0-2 feet	brn	sand, silt and f-gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1850002
Sample Location: X7SB185
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/9/2007	0-2 feet	yel-brn	silt tr fg sand, clay and gravel damp
Time:	956			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

	Analysis	Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1860002
Sample Location: X7SB186
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/9/2007	0-2 feet	yel-brn	silt tr fg sand, clay and gravel damp
Time:	944			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1870002
Sample Location: X7SB187
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/9/2007	0-2 feet	yel-brn	clay and silt tr fg sand, and gravel damp
Time:	950			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1880002
Sample Location: X7SB188
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/9/2007			
Time:	933	0-2 feet	yel-brn	clay and silt tr fg sand, and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1890002
Sample Location: X7SB189
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/9/2007			
Time:	1527	0-2 feet	yel-brn	silt tr fg sand, clay and gravel damp
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC Crane UXO 5 and 7
Project No.: 112G00447 CTO 0034

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: X7SS1900002
Sample Location: X7SB190
Sampled By: Goerdt/Montez
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

		Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:	10/9/2007	0-2 feet	yel-brn	silt tr fg sand, clay and gravel damp
Time:	1535			
Method:	Hand Auger			
Monitor Reading (ppm	NA			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis		Container Requirements	Collected	Other
XRF	FIELD	PLASTIC BAG	YES	
TAL METALS	SW-846-3050B/6020	4 OZ JAR		

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

4571 1140300

[redacted]TRA TECH NUS, INC. CHAIN OF CUSTODY [redacted] | NUMBER 0183 | PAGE 4 OF [redacted]

PROJECT NO:	112G00447
FACILITY:	NSWC Crane
PROJECT MANAGER	R. Businski
PHONE NUMBER	412-921-8308
LABORATORY NAME AND CONTACT:	Lucas Testing Labs
SAMPLERS (SIGNATURE)	[signatures] Jack Martin
FIELD OPERATIONS LEADER	J. Goerdt
PHONE NUMBER	412 443 0244
ADDRESS	940 South Harney St
CARRIER/WAYBILL NUMBER	Fed Ex / 8616 5831 5956
CITY, STATE	Seattle, WA 98108

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G G G G

PRESERVATIVE USED: 4°C 4°C 4°C

TYPE OF ANALYSIS: EXP 846-8330 | TAL Metals 846-3050B/6020 | PAH 846-8270C

	DATE YEAR 2007	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAB (G) COMP (C)	No. OF CONTAINERS	EXP 846-8330	TAL Metals 846-3050B/6020	PAH 846-8270C							COMMENTS
1	10/8	0000	X5FD10080701	QC	0	2	SO	C	1	1									
2	10/2	1045	X7SS002 0002	X702	↓	↓	↓	G	1		1								
3	10/2	1025	X7SS003 0002	X703				↓	1		1								
4	10/2	1100	X7SS004 0002	X704					1		1								
5	10/2	1504	X7SS012 0002	X712					1		1								
6	10/2	0000	X7FD10020701	QC					1		1								
	—	—	~~X7FD10190~~						—		—								
7	10/2	1540	X7SS019 0002	X719					1		1								
8	10/3	0850	X7SS026 0002	X726					1		1								
9	10/3	1150	X7SS039 0002	X739					1		1								
10	10/3	1320	X7SS044 0002	X744					1		1								
11	10/3	1238	X7SS045 0002	X745					1		1								
12	10/3	1244	X7SS046 0002	X746	↓	↓	↓	↓	1		1								

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY ~~J. Goerdt~~	~~10/9/07~~	~~1830~~	1. RECEIVED BY		
2. RELINQUISHED BY James Goerdt	10/10/07	0900	2. RECEIVED BY [signature]	10/11/07	08:35
3. RELINQUISHED BY			3. RECEIVED BY		

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

TETRA TECH NUS, INC. — CHAIN OF CUSTODY — NUMBER 0184 — PAGE 5 OF 7

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
112G00447	NSWC Crane	R. Businski	412 921 8308	Laucks Testing Labs

SAMPLERS (SIGNATURE)	FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
[signatures]	J. Goerdt	412 443 0244	940 South Harney St.
	CARRIER/WAYBILL NUMBER		CITY, STATE
	Fed Ex 8616 5831 5956		Seattle, WA 98108

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G | G | G

PRESERVATIVE USED: 4°C | 4°C | 4°C

TYPE OF ANALYSIS: Exp 846-8330 | TAL Metals 846-3050B/6020 | PAH 846-8270C

	DATE YEAR 2007	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAB (G) COMP (C)	No. OF CONTAINERS	Exp 846-8330	TAL Metals 846-3050B/6020	PAH 846-8270C						COMMENTS
14	10/3	0000	X7FD10030701	QC	0	2	SO	G	1		1							
15	10/3	1231	X7SS048 0002	X748					1		1							
16	10/6	0737	X7SS055 0002	X755					1		1							
17	10/4	1603	X7SS066 0002	X766					1		1							
18	10/5	0854	X7SS071 0002	X771					1			1						
19	10/5	0948	X7SS075 0002	X775					2		1	1						
20	10/5	0912	X7SS079 0002	X779					1			1						
21	10/5	0000	X7FD10050701	QC					1			1						
22	10/5	1423	X7SS081 0002	X781					1			1						
23	10/5	1413	X7SS086 0002	X786					1			1						
24	10/6	1019	X7SS116 0002	X7116					1			1						
25	10/6	0857	X7SS121 0002	X7121					3			3						MS/MSD
26	10/6	0903	X7SS122 0002	X7122					1			1						

1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
James Goerdt	10/10/07	0900	[signature]	10/11/07	08:35
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TNUS-001

4575 TT03403

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER 0185 | PAGE 6 OF 7

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
112G00447	NSWC Crane	R. Basinski	412 921 8308	Lovelace Testing Labs
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
		J. Goerdt	412 443 0244	990 South Harney St
		CARRIER/WAYBILL NUMBER		CITY, STATE
		Fed Ex / 8616 5831 5956		Seattle, WA 98108

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G G G
PRESERVATIVE USED: 4°C 4°C 4°C
TYPE OF ANALYSIS: 846-8330 EXP; 846-TAL 3050B/6020; 846-8270C

	DATE YEAR 2007	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAB (G) COMP (C)	No. OF CONTAINERS	846-8330 EXP	846-TAL 3050B/6020	846-8270C						COMMENTS
1	10/6	0915	X7SS123 0002	X7123	0	2	SO	G	1			1						
2	10/7	0823	X7SS127 0002	X7127	|	|	|	|	1		1	~~1~~						
3	10/6	0820	X7SS129 0002	X7129	|	|	|	|	1			1						
4	10/6	1023	X7SS136 0002	X7136	|	|	|	|	1			1						
5	10/7	1016	X7SS148 0002	X7148	|	|	|	|	3		3							MS/MSD
6	10/7	1002	X7SS152 0002	X7152	|	|	|	|	1		1							
7	10/7	1450	X7SS167 0002	X7167	|	|	|	|	1		1							
8	10/7	1000	X7SS173 0002	X7173	|	|	|	|	1		1							
9	10/7	0950	X7SS174 0002	X7174	|	|	|	|	1		1							
10	10/7	1008	X7SS175 0002	X7175	|	|	|	|	1		1							
11	10/7	1018	X7SS176 0002	X7176	|	|	|	|	1		1							
12	10/7	1036	X7SS177 0002	X7177	|	|	|	|	1		1							
13	10/7	1047	X7SS178 0002	X7178	|	|	|	|	1		1							

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY James Goerdt	10/10/07	0900	1. RECEIVED BY	10/11/07	0835
2. RELINQUISHED BY			2. RECEIVED BY		
3. RELINQUISHED BY			3. RECEIVED BY		

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER 0187 | PAGE 7 OF 7

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
112G00447	NSWC Crane	R. Businski	4129218308	Lucas Testing Labs

SAMPLERS (SIGNATURE): [signatures]

FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
J. Goerdt	4124430244	940 South Harney St

CARRIER/WAYBILL NUMBER	CITY, STATE
Fed Ex / 8616 5831 5956	Seattle, WA 98108

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G, G
PRESERVATIVE USED: 4°C, 4°C, 4°C
TYPE OF ANALYSIS: EXP 846-8330; TAL Metals 846 3050B/6020; 846-8270C

	DATE YEAR 2007	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAB (G) COMP (C)	No. OF CONTAINERS	EXP 846-8330	TAL Metals 846 3050B/6020	846-8270C						COMMENTS
13	10/7	1030	X7SS 179 0002	X7179	0	2	SO	G	1		1							
14	10/7	1055	X7SS 180 0002	X7180	↓	↓	↓	↓	1		1							
15	10/7	1103	X7SS 181 0002	X7181	↓	↓	↓	↓	1		1							
16	10/7	1112	X7SS 182 0002	X7182	↓	↓	↓	↓	1		1							
17	10/7	1130	X7SS 183 0002	X7183	↓	↓	↓	↓	1		1							
18	10/7	1145	X7SS 184 0002	X7184	↓	↓	↓	↓	1		1							
19	10/09	1527	X7SS 189 0002	X7189	↓	↓	↓	↓	3		3							Do ms/msd
20	10/9	1630	X RB10090701	QC	–	–	–	–	5	2	1	2						

1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
James Goerdt	10/10/07	0900	[signature]	10/11/07	08:35
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIB[illegible]: WHITE (ACCOMPANIES SAMPLE) YELLOW (FI[illegible]OPY) PINK (FILE COPY)

Tetra Tech NUS, Inc.

DAILY ACTIVITY LOG

UXO 7 Lead Investigation September 2007 - CRANE NSWC

Facility Name: Crane NSWC
TtNUS Project #: 112G00447
CTO#: 0034

Activity Date: 08/30/2007

TtNUS Personnel: JG = James Goerdt
Weather/Temp: = N/A
Subcontractor Personnel: N/A
Visitors: N/A
Author: James Goerdt

Daily Activity

Time	Notes
13:45	JG met with Tom Brent to locate Township and Section for UXO 7. Information needed for utility clearance with IUPPS.
15:00	JG marked boundaries of field investigation area with white pin flags to assist utility clearance personnel. Spoke with site employee informing us that the demo range located just to the west of the site is an active facility and demolition blasting occurs nearly every morning. Site personnel will ask us daily around 10:30 to leave the area until around 12:30. Site contact is Walt Waggoner (812-854-1317). JG to contact Mr. Waggoner upon beginning site investigation at UXO 7 and inform him of our schedule.

Activity Date: 08/31/2007

TtNUS Personnel: JG = James Goerdt
Weather/Temp: = N/A
Subcontractor Personnel: N/A
Visitors: N/A
Author: James Goerdt

Daily Activity

Time	Notes
09:15	JG contacted IUPPS for utility clearance at UXO 7 (spoke with Carol). Martin County, Perry Township, Section 35. Ticket #0708310545. Utilities contacted will be Crane and Verizon. Clearance period is 9/4/07 through 9/20/07.

Activity Date: 09/17/2007

TtNUS Personnel: JG = James Goerdt
Weather/Temp: = N/A
Subcontractor Personnel: N/A
Visitors: N/A
Author: James Goerdt

Daily Activity

Time	Notes
10:50	Due to change in field investigation dates, JG phoned IUPPS to extend utility clearance #0708310545. Ticket has been extended to 10/7/07. Changes and/or extensions need to be called in by 10/3/07. New ticket #0709171384.

Activity Date: 10/01/2007

TtNUS Personnel: JG = James Goerdt, FR = Fred Ramser
Weather/Temp: = N/A
Subcontractor Personnel: N/A
Visitors: N/A
Author: James Goerdt

Daily Activity

Time	Notes
09:00	JG and FR travel from Pittsburgh to NSWC Crane.
14:30	JG and FR stop at Wal-Mart in Martinsville, IN on way to Crane to purchase needed field supplies.
16:30	JG and FR stop at hotel to drop off luggage and to check in. Leave FR vehicle at hotel and en-route to Crane.
16:45	JG and FR arrive at Crane Visitors Center to obtain passes. FR has left his ID in rental vehicle back at hotel and unable to obtain pass. JG obtains his pass, leaves FR at gate and drives to Bldg 3245 to check and make sure all equipment has arrived. JG returns to the visitors center to pick up FR. En-route back to Bloomington, stopping off at Wal-Mart for additional field supplies.

Activity Date: 10/02/2007

TtNUS Personnel: JG = James Goerdt, FR = Fred Ramser, FM = Frank Montes
Weather/Temp: = N/A
Subcontractor Personnel: N/A
Visitors: N/A
Author: James Goerdt

Daily Activity

Time	Notes
07:15	JG, FR, and FM arrive at Crane security to secure visitor passes. Arrive at Bldg 3245 at 07:30.
07:45	JG phoned Val Plachy at Tetra Tech Pittsburgh requesting she have labels made up for the UXO 5 and 7 samples.
07:55	JG phoned Walt Wagoner at the Demo Range to inform him we would be in the area collecting soil samples at SWMU 7 for the next 10 days. He indicated they would not be doing any work today. Other weekdays we will clear out between 10:30-12:30. Not necessary to leave on weekends as no demo work is performed.
08:50	JG, FR, and FM leave Bldg 3245 heading to UXO 7 to begin locating and collecting soil samples. Stopped at Crane gas station along the way.
09:20	Arrived at the gate leading to UXO 7 off of Highways 45/8. Gate is locked. Spoke with Carmen at Bldg 6141 who said she could unlock it. When she arrived at gate it was noticed that security had bypassed her lock and we could not gain access. Security was called. She indicated that she would leave gate unlocked during normal business hours Mon-Fri. Security arrived at 09:45 and unlocked gate. Tetra Tech would use alternate route (Hwy 333/8) remainder of time so as not to be held up by a locked gate.
09:50	Began marking out and sampling locations within the main target area and the hillside behind the target area. FR left after an hour with samples collected to begin XRF analysis back at the field office.
17:00	FM leaves Crane. FR finishing analyzing last samples of the day. Twenty samples collected today at the main target area and the hillside behind the target area. All concentrations were well below the 400 mg/kg.
17:20	JG and FR leave Crane.

Activity Date: 10/04/2007

TtNUS Personnel: JG = James Goerdt, FR = Fred Ramser, FM = Frank Montes
Weather/Temp: = N/A
Subcontractor Personnel: N/A
Visitors: John Ruh – University of Indiana
Author: James Goerdt

Daily Activity

Time	Notes
07:30	JG arrives at Crane. FR and FM already on-site. FR is continuing with the XRF of field samples. FM preparing to continue collecting soil samples at UXO 7.
08:00	JG on phone with Ralph Basinski discussing SWMU 8. See SWMU 8 activities regarding
09:15	JG and FM arrive at UXO 7 to mark out and sample soil borings. FM to collect soil samples. JG to SWMU 8 to collect confirmation samples (see daily activity under 112G00352). FR at field lab analyzing soil samples with XRF.
12:45	JG phoned field office and requested that FM meet him at UXO 7.
12:55	JG arrives at UXO 7 to mark out additional soil sample locations at East Trap Range for FM.
13:50	JG finished marking out sample locations X7SB063-80 at East Trap Range.
16:30	FM leaves Crane.
17:00	FR exits Crane on way to drop off SWMU 8 samples at Fed Ex, as well as shipping PID and LEL Meter back to rental company.
17:30	JG exits Crane en-route to hotel.

Activity Date: 10/07/2007

TtNUS Personnel: JG = James Goerdt, FR = Fred Ramser, FM = Frank Montes
Weather/Temp: = Very Hot – Upper 80's
Subcontractor Personnel: N/A
Visitors: N/A
Author: James Goerdt

Daily Activity

Time	Notes
07:15	JG arrives at Crane. FR and FM on-site. FR continues to run XRF on soil samples. FM to UXO 7 to continue with soil sampling. JG working on downloading GPS data to laptop.
08:25	JG arrives at UXO 7 to begin sampling delineation samples around locations X7SB55 and X7SB45/46 which had XRF lead concentrations above 400 mg/kg.
11:50	JG finished collecting delineation samples. Checked on FM at former OPR. JG to grab lunch, drop off samples, and return to help FM sample at the former OPR.
14:30	FM finished sampling. Fueling vehicle and departing Crane.
15:30	JG finished collecting remaining samples at the Old Pistol Range. All samples have now been collected at UXO 7. JG to start collecting GPS points.
17:45	JG finished GPS at the former West Trap Range. Heading back to Bldg. 3245 to drop off samples and check in with FR.
18:30	FR informed JG that the XRF is not functioning correctly. Unsure of the problem. Plan is to contact Pine Environmental on Monday morning. JG and FR depart Crane.
19:15	JG at Kroeger Grocery to purchase additional Ziploc baggies.
20:00	JG completing daily activity logs and updating GPS information. E-mail sent to Ralph Basinski regarding problem with XRF.

Activity Date: 10/09/2007

TtNUS Personnel: JG = James Goerdt, FR = Fred Ramser, FM = Frank Montes
Weather/Temp: = N/A
Subcontractor Personnel: N/A
Visitors: N/A
Author: James Goerdt

Daily Activity

Time	Notes
07:10	JG arrives onsite at Crane. FR and FM also onsite.
08:00	JG and FM to UXO 7 to finish soil sampling. FR contacting Pine Environmental regarding the XRF equipment. FR will continue to process samples for XRF.
09:50	JG spoke with FR. Pine Environmental will be sending out another XRF unit for Tuesday delivery.
10:05	JG spoke with Ralph Basinski regarding sample selection for Metals and PAH analysis at UXO 7. Ralph suggested selecting approximately 10 samples (5 from each trap range) for PAH analysis. Also selecting approximately 30 samples to be sent to the fixed-base laboratory for lead analysis.
16:30	FR generated rinsate blank (RB10090701) by pouring water over decontaminated hand auger and letting it flow into sample containers. The DI used was NERL Reagent Grade Water from VWR International, LLC. Lot # 0817027. Expiration date of August 2008.

Activity Date: 10/10/2007

TtNUS Personnel: JG = James Goerdt
Weather/Temp: = N/A
Subcontractor Personnel: N/A
Visitors: N/A
Author: James Goerdt

Daily Activity

Time	Notes
06:30	JG arrives at Crane to finish packing equipment for shipment back to rental companies.
09:50	JG dropping off equipment at Fed Ex. Remainder of day spend traveling back to Pittsburgh. End of field work.

Activity Date: 10/24/2007

TtNUS Personnel: JG = James Goerdt
Weather/Temp: = N/A
Subcontractor Personnel: N/A
Visitors: N/A
Author: James Goerdt

Daily Activity

Time	Notes
09:50	JG dropping off equipment at Fed Ex. Remainder of day spent traveling back to Pittsburgh.

APPENDIX B

SITE PHOTOGRAPHS

General view to the north of showing areas within UXO 7

Retention pond located northeast of the Old Pistol Range

Backside of the Main Target Area of the Old Rifle Range

Top of the Main Target Area

Front view of the Main Target Area

View of hillside south of the Main Target Area

Typical view of firing berms

West Trap Range looking west toward tree line

APPENDIX C

ANALYTICAL DATA

e

order	001	002	003	004	005	006	007	008	009	010	011
nsample	X7SS0010002	X7SS0020002	X7SS0030002	X7SS0040002	X7SS0050002	X7SS0060002	X7SS0060002-D	X7SS0070002	X7SS0080002	X7SS0090002	X7SS0090002-D
location	X7-SB001	X7-SB002	X7-SB003	X7-SB004	X7-SB005	X7-SB006	X7-SB006	X7-SB007	X7-SB008	X7-SB009	X7-SB009
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0010002	X7SS0020002	X7SS0030002	X7SS0040002	X7SS0050002	X7SS0060002	X7SS0060002D	X7SS0070002	X7SS0080002	X7SS0090002	X7SS0090002D
sample_dat	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate							X7SS0060002				X7SS0090002
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_001	c_002	c_003	c_004	c_005	c_006	c_007	c_008	c_009	c_010	c_011
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM		12800	7910	8600							
ANTIMONY		0.71 U	5.8 J	11.1 J							
ARSENIC		12.9	16.4	9.34							
BARIUM		110	907	949							
BERYLLIUM		0.82	1.35	0.67							
CADMIUM		0.683	1.09	0.923							
CALCIUM		2500	4430	1810							
CHROMIUM		24.6	66.6	25							
COBALT		21.9	14.3	13.5							
COPPER		20.5	21.7	33.8							
IRON		40200	90700	37600							
LEAD		22.8	140	125							
MAGNESIUM		2340	923	999							
MANGANESE		694	974	749							
NICKEL		28.7	50.2	16.8							
POTASSIUM		1790	626	1040							
SELENIUM		0.65	0.559	0.46							
SILVER		0.102	0.117	0.113							
SODIUM		75.7 U	22.7 U	21.1 U							
THALLIUM		0.25	0.0808	0.138							
VANADIUM		29.6	46.3	23.7							
ZINC		59.3	110	111							
XRF Lead (mg/kg)											
LEAD	49.5	61	101.67	254	74.33	0 U	38	0 U	42.33	47	83.33

order	012	013	014	015	016	017	018	019	020	021	022
nsample	X7SS0100002	X7SS0110002	X7SS0120002	X7SS0120002-AVG	X7SS0120002-D	X7SS0130002	X7SS0140002	X7SS0150002	X7SS0160002	X7SS0170002	X7SS0180002
location	X7-SB010	X7-SB011	X7-SB012	X7-SB012	X7-SB012	X7-SB012	X7-SB014	X7-SB015	X7-SB016	X7-SB017	X7-SB018
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0100002	X7SS0110002	X7SS0120002	X7SS0120002-AVG	X7FD10020701	X7SS0130002	X7SS0140002	X7SS0150002	X7SS0160002	X7SS0170002	X7SS0180002
sample_dat	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate					X7SS0120002						
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_012	c_013	c_014	c_015	c_016	c_017	c_018	c_019	c_020	c_021	c_022
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM			14000	15250	16500						
ANTIMONY			1.6 J	1.015 J	0.86 U						
ARSENIC			7.93	8.01	8.09						
BARIUM			95.6	99.3	103						
BERYLLIUM			0.909	0.8645	0.82						
CADMIUM			0.959	0.824	0.689						
CALCIUM			13400	12300	11200						
CHROMIUM			22.3	21.7	21.1						
COBALT			11.4	12.05	12.7						
COPPER			30.9	26.6	22.3						
IRON			37200	30200	23200						
LEAD			43.9	35.25	26.6						
MAGNESIUM			2130	2240	2350						
MANGANESE			1370	1290	1210						
NICKEL			17.8	17.65	17.5						
POTASSIUM			1190	1145	1100						
SELENIUM			0.618	0.61	0.602						
SILVER			0.11	0.1065	0.103						
SODIUM			36.8 U	37.7 U	38.6 U						
THALLIUM			0.204	0.215	0.226						
VANADIUM			34.9	35.25	35.6						
ZINC			68.1	63.8	59.5						
XRF Lead (mg/kg)											
LEAD	88.67	0 U	45.67			49.67	61	38	39	49.33	113.67

order	023	024	025	026	027	028	029	030	031	032	033
nsample	X7SS0190002	X7SS0200002	X7SS0210002	X7SS0220002	X7SS0230002	X7SS0240002	X7SS0250002	X7SS0260002	X7SS0270002	X7SS0280002	X7SS0290002
location	X7-SB019	X7-SB020	X7-SB021	X7-SB022	X7-SB023	X7-SB024	X7-SB025	X7-SB026	X7-SB027	X7-SB028	X7-SB029
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0190002	X7SS0200002	X7SS0210002	X7SS0220002	X7SS0230002	X7SS0240002	X7SS0250002	X7SS0260002	X7SS0270002	X7SS0280002	X7SS0290002
sample_dat	20071002	20071002	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate											
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_023	c_024	c_025	c_026	c_027	c_028	c_029	c_030	c_031	c_032	c_033
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM	13300										
ANTIMONY	3.7 J										
ARSENIC	5.69										
BARIUM	118										
BERYLLIUM	0.873										
CADMIUM	0.712										
CALCIUM	4700										
CHROMIUM	21										
COBALT	12.4										
COPPER	427										
IRON	29200										
LEAD	537										
MAGNESIUM	1950										
MANGANESE	950										
NICKEL	24.8										
POTASSIUM	1780										
SELENIUM	0.553										
SILVER	0.105										
SODIUM	57.8 U										
THALLIUM	0.157										
VANADIUM	27.1										
ZINC	148										
XRF Lead (mg/kg)											
LEAD	255.33	33.67	36	0 U	30	30	34	29	0 U	30.5	0 U

order	034	035	036	037	038	039	040	041	042	043	044
nsample	X7SS0300002	X7SS0300002-D	X7SS0310002	X7SS0320002	X7SS0330002	X7SS0340002	X7SS0350002	X7SS0360002	X7SS0370002	X7SS0380002	X7SS0390002
location	X7-SB030	X7-SB030	X7-SB031	X7-SB032	X7-SB033	X7-SB034	X7-SB035	X7-SB036	X7-SB037	X7-SB038	X7-SB039
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0300002	X7SS0300002D	X7SS0310002	X7SS0320002	X7SS0330002	X7SS0340002	X7SS0350002	X7SS0360002	X7SS0370002	X7SS0380002	X7SS0390002
sample_dat	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate		X7SS0300002									
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_034	c_035	c_036	c_037	c_038	c_039	c_040	c_041	c_042	c_043	c_044
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM											15300
ANTIMONY											96.2 J
ARSENIC											7.2
BARIUM											91.2
BERYLLIUM											0.637
CADMIUM											0.895
CALCIUM											26700
CHROMIUM											20.4
COBALT											9.72
COPPER											94.6
IRON											26600
LEAD											495
MAGNESIUM											7000
MANGANESE											737
NICKEL											14.5
POTASSIUM											1100
SELENIUM											0.406
SILVER											0.109
SODIUM											65.3 U
THALLIUM											0.197
VANADIUM											32.1
ZINC											89.8
XRF Lead (mg/kg)											
LEAD	48.67	29	37	33.67	32	0 U	0 U	0 U	43.33	213.33	382

from Q:\NAVY_S_Crane_NSWC\MEGAN_20080611
res.xls

order	045	046	047	048	049	050	051	052	053	054	055
nsample	X7SS0400002	X7SS0410002	X7SS0420002	X7SS0430002	X7SS0440002	X7SS0450002	X7SS0450002-AVG	X7SS0450002-D	X7SS0460002	X7SS0470002	X7SS0480002
location	X7-SB040	X7-SB041	X7-SB042	X7-SB043	X7-SB044	X7-SB045	X7-SB045	X7-SB045	X7-SB046	X7-SB047	X7-SB048
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0400002	X7SS0410002	X7SS0420002	X7SS0430002	X7SS0440002	X7SS0450002	X7SS0450002-AVG	X7FD10030701	X7SS0460002	X7SS0470002	X7SS0480002
sample_dat	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate								X7SS0450002			
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_045	c_046	c_047	c_048	c_049	c_050	c_051	c_052	c_053	c_054	c_055
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM					14900	13400	13100	12800	16300		15700
ANTIMONY					4.5 J	3.9 J	6.65 J	9.4 J	24.5 J		5.6 J
ARSENIC					6.34	7.72	9.01	10.3	7.38		7.5
BARIUM					61	69.4	65.9	62.4	85.3		80.9
BERYLLIUM					0.553	0.601	0.8905	1.18	0.776		0.612
CADMIUM					0.462	0.387	0.668	0.949	0.594		1.05
CALCIUM					735	917	852.5	788	3670		1300
CHROMIUM					24.1	27.4	33.55	39.7	23.4		23.2
COBALT					12.1	13.7	12.55	11.4	12		12.5
COPPER					96.1	128	132	136	283		93.5
IRON					32100	38600	39250	39900	22900		26600
LEAD					199	286	344.5	403	1100		190
MAGNESIUM					1680	1610	1395	1180	2760		1720
MANGANESE					709	919	733	547	1060		461
NICKEL					11.7	14	17.05	20.1	15.7		13.7
POTASSIUM					852	788	779.5	771	1100		894
SELENIUM					0.249	0.273	0.331	0.389	0.368		0.365
SILVER					0.064	0.0695	0.0953	0.121	0.115		0.1
SODIUM					59.2 U	16.1 U	24.45 U	32.8 U	34.1 U		44.4 U
THALLIUM					0.17	0.181	0.173	0.165	0.223		0.197
VANADIUM					32.5	34.7	40.2	45.7	35.9		36.9
ZINC					50.3	52.3	57.7	63.1	79.4		54.1
XRF Lead (mg/kg)											
LEAD	124	30.67	0 U	62	204	562			701	69.33	146.33

order	056	057	058	059	060	061	062	063	064	065	066
nsample	X7SS0490002	X7SS0500002	X7SS0510002	X7SS0520002	X7SS0530002	X7SS0540002	X7SS0550002	X7SS0550002-D	X7SS0560002	X7SS0570002	X7SS0580002
location	X7-SB049	X7-SB050	X7-SB051	X7-SB052	X7-SB053	X7-SB054	X7-SB055	X7-SB055	X7-SB056	X7-SB057	X7-SB058
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0490002	X7SS0500002	X7SS0510002	X7SS0520002	X7SS0530002	X7SS0540002	X7SS0550002	X7SS0550002D(3)	X7SS0560002	X7SS0570002	X7SS0580002
sample_dat	20071003	20071003	20071003	20071003	20071004	20071004	20071006	20071004	20071004	20071004	20071006
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate								X7SS0550002			
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_056	c_057	c_058	c_059	c_060	c_061	c_062	c_063	c_064	c_065	c_066
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM							11400				
ANTIMONY							37.9 J				
ARSENIC							10.8				
BARIUM							86.1				
BERYLLIUM							0.715				
CADMIUM							1.27				
CALCIUM							1080				
CHROMIUM							18.6				
COBALT							14.9				
COPPER							197				
IRON							26700				
LEAD							1160				
MAGNESIUM							1040				
MANGANESE							1110				
NICKEL							18.6				
POTASSIUM							579				
SELENIUM							0.663				
SILVER							0.161				
SODIUM							40.5 U				
THALLIUM							0.171				
VANADIUM							32				
ZINC							77.9				
XRF Lead (mg/kg)											
LEAD	28	62.67	35	39	37	31	741	1014.67	0 U	0 U	105

order	067	068	069	070	071	072	073	074	075	076	077
nsample	X7SS0580002-D	X7SS0590002	X7SS0600002	X7SS0610002	X7SS0620002	X7SS0630002	X7SS0640002	X7SS0650002	X7SS0660002	X7SS0670002	X7SS0680002
location	X7-SB058	X7-SB059	X7-SB060	X7-SB061	X7-SB062	X7-SB063	X7-SB064	X7-SB065	X7-SB066	X7-SB067	X7-SB068
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0580002D(4)	X7SS0590002	X7SS0600002	X7SS0610002	X7SS0620002	X7SS0630002	X7SS0640002	X7SS0650002	X7SS0660002	X7SS0670002	X7SS0680002
sample_dat	20071004	20071004	20071004	20071004	20071004	20071004	20071004	20071004	20071004	20071004	20071004
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate	X7SS0580002										
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_067	c_068	c_069	c_070	c_071	c_072	c_073	c_074	c_075	c_076	c_077
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM									8700		
ANTIMONY									0.21 J		
ARSENIC									3.86		
BARIUM									163		
BERYLLIUM									0.407		
CADMIUM									0.662		
CALCIUM									763		
CHROMIUM									10.2		
COBALT									6.79		
COPPER									6.34		
IRON									12200		
LEAD									10.3		
MAGNESIUM									830		
MANGANESE									347		
NICKEL									8.75		
POTASSIUM									476		
SELENIUM									0.546		
SILVER									0.0627		
SODIUM									46.8		
THALLIUM									0.138		
VANADIUM									19.9		
ZINC									30.9		
XRF Lead (mg/kg)											
LEAD	85	29	0 U	0 U	27	0 U	0 U	33	28.5	0 U	0 U

order	078	079	080	081	082	083	084	085	086	087	088
nsample	X7SS0690002	X7SS0700002	X7SS0710002	X7SS0710002-D	X7SS0720002	X7SS0730002	X7SS0740002	X7SS0750002	X7SS0760002	X7SS0770002	X7SS0780002
location	X7-SB069	X7-SB070	X7-SB071	X7-SB071	X7-SB072	X7-SB073	X7-SB074	X7-SB075	X7-SB076	X7-SB077	X7-SB078
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0690002	X7SS0700002	X7SS0710002	X7SS0710002D	X7SS0720002	X7SS0730002	X7SS0740002	X7SS0750002	X7SS0760002	X7SS0770002	X7SS0780002
sample_dat	20071005	20071009	20071005	20071005	20071004	20071005	20071005	20071005	20071005	20071005	20071005
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate				X7SS0710002							
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_078	c_079	c_080	c_081	c_082	c_083	c_084	c_085	c_086	c_087	c_088
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE			1.6 U					1.8 U			
ACENAPHTHENE			1.2 U					4.9 J			
ACENAPHTHYLENE			0.64 U					0.71 U			
ANTHRACENE			0.85 U					7.2			
BENZO(A)ANTHRACENE			12					140			
BENZO(A)PYRENE			17					170			
BENZO(B)FLUORANTHENE			20					230			
BENZO(G,H,I)PERYLENE			7.1					48			
BENZO(K)FLUORANTHENE			8					92			
CHRYSENE			13					160			
DIBENZO(A,H)ANTHRACENE			1.1 U					18			
FLUORANTHENE			15					180			
FLUORENE			0.65 U					4.6 J			
INDENO(1,2,3-CD)PYRENE			4.8 J					60			
NAPHTHALENE			1.2 U					1.3 U			
PHENANTHRENE			1.1 U					30			
PYRENE			17					200			
Inorganics (mg/kg)											
ALUMINUM								14800			
ANTIMONY								0.93 J			
ARSENIC								8.54			
BARIUM								627			
BERYLLIUM								0.634			
CADMIUM								1.12			
CALCIUM								1930			
CHROMIUM								16.5			
COBALT								10.3			
COPPER								15			
IRON								23000			
LEAD								33.1			
MAGNESIUM								1410			
MANGANESE								770			
NICKEL								14.8			
POTASSIUM								853			
SELENIUM								0.575			
SILVER								0.0844			
SODIUM								66.7			
THALLIUM								0.209			
VANADIUM								32.8			
ZINC								63			
XRF Lead (mg/kg)											
LEAD	0 U	22	0 U	0 U	29	41	38	29.67	0 U	0 U	28

order	089	090	091	092	093	094	095	096	097	098	099
nsample	X7SS0790002	X7SS0790002-AVG	X7SS0790002-D	X7SS0800002	X7SS0810002	X7SS0820002	X7SS0820002-D	X7SS0830002	X7SS0840002	X7SS0850002	X7SS0860002
location	X7-SB079	X7-SB079	X7-SB079	X7-SB080	X7-SB081	X7-SB082	X7-SB082	X7-SB083	X7-SB084	X7-SB085	X7-SB086
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0790002	X7SS0790002-AVG	X7FD10050701	X7SS0800002	X7SS0810002	X7SS0820002	X7SS0820002D	X7SS0830002	X7SS0840002	X7SS0850002	X7SS0860002
sample_dat	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate			X7SS0790002				X7SS0820002				
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_089	c_090	c_091	c_092	c_093	c_094	c_095	c_096	c_097	c_098	c_099
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE	1.6 U	1.6 U	1.6 U		1.6 U						1.7 U
ACENAPHTHENE	1.1 U	1.15 U	1.2 U		1.1 U						1.2 U
ACENAPHTHYLENE	0.63 U	0.635 U	0.64 U		0.64 U						0.68 U
ANTHRACENE	0.83 U	0.84 U	0.85 U		0.84 U						0.9 U
BENZO(A)ANTHRACENE	0.87 U	0.88 U	0.89 U		0.88 U						0.95 UJ
BENZO(A)PYRENE	0.96 U	0.97 U	0.98 U		0.97 U						1 UJ
BENZO(B)FLUORANTHENE	0.87 U	0.88 U	0.89 U		0.88 U						0.95 UJ
BENZO(G,H,I)PERYLENE	0.96 U	0.97 U	0.98 U		0.97 U						1 UJ
BENZO(K)FLUORANTHENE	0.45 U	0.455 U	0.46 U		0.46 U						0.49 UJ
CHRYSENE	0.83 U	0.84 U	0.85 U		0.84 U						0.9 UJ
DIBENZO(A,H)ANTHRACENE	1 U	1.05 U	1.1 U		1.1 U						1.1 UJ
FLUORANTHENE	0.83 U	0.84 U	0.85 U		0.84 U						0.9 U
FLUORENE	0.64 U	0.645 U	0.65 U		0.64 U						0.69 U
INDENO(1,2,3-CD)PYRENE	1.2 U	1.25 U	1.3 U		1.2 U						1.3 UJ
NAPHTHALENE	1.1 U	1.15 U	1.2 U		1.1 U						1.2 U
PHENANTHRENE	1 U	1.05 U	1.1 U		1.1 U						1.1 U
PYRENE	1 U	1.05 U	1.1 U		1.1 U						1.1 UJ
Inorganics (mg/kg)											
ALUMINUM											
ANTIMONY											
ARSENIC											
BARIUM											
BERYLLIUM											
CADMIUM											
CALCIUM											
CHROMIUM											
COBALT											
COPPER											
IRON											
LEAD											
MAGNESIUM											
MANGANESE											
NICKEL											
POTASSIUM											
SELENIUM											
SILVER											
SODIUM											
THALLIUM											
VANADIUM											
ZINC											
XRF Lead (mg/kg)											
LEAD	0 U			41	34	32	31	0 U	0 U	41	0 U

order	100	101	102	103	104	105	106	107	108	109	110
nsample	X7SS0870002	X7SS0880002	X7SS0890002	X7SS0900002	X7SS0910002	X7SS0920002	X7SS0930002	X7SS0940002	X7SS0950002	X7SS0960002	X7SS0970002
location	X7-SB087	X7-SB088	X7-SB089	X7-SB090	X7-SB091	X7-SB092	X7-SB093	X7-SB094	X7-SB095	X7-SB096	X7-SB097
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0870002	X7SS0880002	X7SS0890002	X7SS0900002	X7SS0910002	X7SS0920002	X7SS0930002	X7SS0940002	X7SS0950002	X7SS0960002	X7SS0970002
sample_dat	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071006	20071006	20071007
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate											
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_100	c_101	c_102	c_103	c_104	c_105	c_106	c_107	c_108	c_109	c_110
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM											
ANTIMONY											
ARSENIC											
BARIUM											
BERYLLIUM											
CADMIUM											
CALCIUM											
CHROMIUM											
COBALT											
COPPER											
IRON											
LEAD											
MAGNESIUM											
MANGANESE											
NICKEL											
POTASSIUM											
SELENIUM											
SILVER											
SODIUM											
THALLIUM											
VANADIUM											
ZINC											
XRF Lead (mg/kg)											
LEAD	0 U	29	29	40	0 U	26	0 U	0 U	50	0 U	0 U

order	111	112	113	114	115	116	117	118	119	120	121
nsample	X7SS0980002	X7SS0990002	X7SS1000002	X7SS1010002	X7SS1020002	X7SS1030002	X7SS1040002	X7SS1050002	X7SS1060002	X7SS1070002	X7SS1080002
location	X7-SB098	X7-SB099	X7-SB100	X7-SB101	X7-SB102	X7-SB103	X7-SB104	X7-SB105	X7-SB106	X7-SB107	X7-SB108
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0980002	X7SS0990002	X7SS1000002	X7SS1010002	X7SS1020002	X7SS1030002	X7SS1040002	X7SS1050002	X7SS1060002	X7SS1070002	X7SS1080002
sample_dat	20071007	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071009	20071009
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate											
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_111	c_112	c_113	c_114	c_115	c_116	c_117	c_118	c_119	c_120	c_121
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM											
ANTIMONY											
ARSENIC											
BARIUM											
BERYLLIUM											
CADMIUM											
CALCIUM											
CHROMIUM											
COBALT											
COPPER											
IRON											
LEAD											
MAGNESIUM											
MANGANESE											
NICKEL											
POTASSIUM											
SELENIUM											
SILVER											
SODIUM											
THALLIUM											
VANADIUM											
ZINC											
XRF Lead (mg/kg)											
LEAD	0 U	37.33	0 U	37	45.5	27	29	31	0 U	28	25.67

order	122	123	124	125	126	127	128	129	130	131	132
nsample	X7SS1090002	X7SS1100002	X7SS1110002	X7SS1120002	X7SS1120002-D	X7SS1130002	X7SS1140002	X7SS1150002	X7SS1160002	X7SS1170002	X7SS1180002
location	X7-SB109	X7-SB110	X7-SB111	X7-SB112	X7-SB112	X7-SB113	X7-SB114	X7-SB115	X7-SB116	X7-SB117	X7-SB118
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1090002	X7SS1100002	X7SS1110002	X7SS1120002	X7SS1120002D	X7SS1130002	X7SS1140002	X7SS1150002	X7SS1160002	X7SS1170002	X7SS1180002
sample_dat	20071009	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate					X7SS1120002						
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_122	c_123	c_124	c_125	c_126	c_127	c_128	c_129	c_130	c_131	c_132
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE									3.9 J		
ACENAPHTHENE									30		
ACENAPHTHYLENE									0.64 U		
ANTHRACENE									64		
BENZO(A)ANTHRACENE									640		
BENZO(A)PYRENE									890 J		
BENZO(B)FLUORANTHENE									1400 J		
BENZO(G,H,I)PERYLENE									340 J		
BENZO(K)FLUORANTHENE									490 J		
CHRYSENE									730		
DIBENZO(A,H)ANTHRACENE									69 J		
FLUORANTHENE									780		
FLUORENE									16		
INDENO(1,2,3-CD)PYRENE									330 J		
NAPHTHALENE									1.2 U		
PHENANTHRENE									280		
PYRENE									1200		
Inorganics (mg/kg)											
ALUMINUM											
ANTIMONY											
ARSENIC											
BARIUM											
BERYLLIUM											
CADMIUM											
CALCIUM											
CHROMIUM											
COBALT											
COPPER											
IRON											
LEAD											
MAGNESIUM											
MANGANESE											
NICKEL											
POTASSIUM											
SELENIUM											
SILVER											
SODIUM											
THALLIUM											
VANADIUM											
ZINC											
XRF Lead (mg/kg)											
LEAD	25.67	41	36	35	29	31	0 U	31	0 U	30.67	31.33

order	133	134	135	136	137	138	139	140	141	142	143
nsample	X7SS1190002	X7SS1200002	X7SS1210002	X7SS1220002	X7SS1230002	X7SS1240002	X7SS1250002	X7SS1260002	X7SS1270002	X7SS1270002-D	X7SS1280002
location	X7-SB119	X7-SB120	X7-SB121	X7-SB122	X7-SB123	X7-SB124	X7-SB125	X7-SB126	X7-SB127	X7-SB127	X7-SB128
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1190002	X7SS1200002	X7SS1210002	X7SS1220002	X7SS1230002	X7SS1240002	X7SS1250002	X7SS1260002	X7SS1270002	X7SS1270002D	X7SS1280002
sample_dat	20071007	20071006	20071006	20071006	20071006	20071006	20071006	20071007	20071007	20071007	20071006
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate										X7SS1270002	
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_133	c_134	c_135	c_136	c_137	c_138	c_139	c_140	c_141	c_142	c_143
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE			40	1.8 U	7						
ACENAPHTHENE			550 J	1.3 U	95						
ACENAPHTHYLENE			0.75 U	0.73 U	27						
ANTHRACENE			970	0.96 U	170						
BENZO(A)ANTHRACENE			6400	10	1200						
BENZO(A)PYRENE			8100 J	14	1600 J						
BENZO(B)FLUORANTHENE			12000 J	20	2700 J						
BENZO(G,H,I)PERYLENE			2900 J	5.7 J	730 J						
BENZO(K)FLUORANTHENE			4700 J	6.4 J	880 J						
CHRYSENE			7400	13	1500						
DIBENZO(A,H)ANTHRACENE			970 J	1.2 U	150 J						
FLUORANTHENE			8700	14	1300						
FLUORENE			270	0.74 U	42						
INDENO(1,2,3-CD)PYRENE			2900 J	4.7 J	670 J						
NAPHTHALENE			1.4 U	1.3 U	1 U						
PHENANTHRENE			4900	1.2 U	680						
PYRENE			14000	15	2700						
Inorganics (mg/kg)											
ALUMINUM									19400		
ANTIMONY									0.61 J		
ARSENIC									8.84		
BARIUM									145		
BERYLLIUM									0.883		
CADMIUM									1.43		
CALCIUM									3720		
CHROMIUM									23.9		
COBALT									14.4		
COPPER									24.7		
IRON									26000		
LEAD									25.3		
MAGNESIUM									2510		
MANGANESE									677		
NICKEL									17.1		
POTASSIUM									1750		
SELENIUM									0.405		
SILVER									0.129		
SODIUM									62.2 U		
THALLIUM									0.231		
VANADIUM									38.1		
ZINC									64.4		
XRF Lead (mg/kg)											
LEAD	37	27	30.67	38	37.5	41.33	32	44.33	35	32	33.5

order	144	145	146	147	148	149	150	151	152	153	154
nsample	X7SS1290002	X7SS1300002	X7SS1310002	X7SS1320002	X7SS1330002	X7SS1340002	X7SS1350002	X7SS1360002	X7SS1370002	X7SS1380002	X7SS1390002
location	X7-SB129	X7-SB130	X7-SB131	X7-SB132	X7-SB133	X7-SB134	X7-SB135	X7-SB136	X7-SB137	X7-SB138	X7-SB139
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1290002	X7SS1300002	X7SS1310002	X7SS1320002	X7SS1330002	X7SS1340002	X7SS1350002	X7SS1360002	X7SS1370002	X7SS1380002	X7SS1390002
sample_dat	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate											
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_144	c_145	c_146	c_147	c_148	c_149	c_150	c_151	c_152	c_153	c_154
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE	1.6 U							1.7 U			
ACENAPHTHENE	1.2 U							1.2 U			
ACENAPHTHYLENE	0.65 U							0.68 U			
ANTHRACENE	4.2 J							0.9 U			
BENZO(A)ANTHRACENE	55							0.95 U			
BENZO(A)PYRENE	88							1 U			
BENZO(B)FLUORANTHENE	130							0.95 U			
BENZO(G,H,I)PERYLENE	36							1 U			
BENZO(K)FLUORANTHENE	48							0.49 U			
CHRYSENE	76							0.9 U			
DIBENZO(A,H)ANTHRACENE	1.1 U							1.1 U			
FLUORANTHENE	76							0.9 U			
FLUORENE	0.66 U							0.69 U			
INDENO(1,2,3-CD)PYRENE	39							1.3 U			
NAPHTHALENE	1.2 U							1.2 U			
PHENANTHRENE	21							1.1 U			
PYRENE	86							3.2 J			
Inorganics (mg/kg)											
ALUMINUM											
ANTIMONY											
ARSENIC											
BARIUM											
BERYLLIUM											
CADMIUM											
CALCIUM											
CHROMIUM											
COBALT											
COPPER											
IRON											
LEAD											
MAGNESIUM											
MANGANESE											
NICKEL											
POTASSIUM											
SELENIUM											
SILVER											
SODIUM											
THALLIUM											
VANADIUM											
ZINC											
XRF Lead (mg/kg)											
LEAD	46	37	43.33	37.33	31	34	43.67	30.67	29	31	44.67

order	155	156	157	158	159	160	161	162	163	164	165
nsample	X7SS1400002	X7SS1410002	X7SS1420002	X7SS1430002	X7SS1430002-D	X7SS1440002	X7SS1440002-D	X7SS1450002	X7SS1460002	X7SS1470002	X7SS1480002
location	X7-SB140	X7-SB141	X7-SB142	X7-SB143	X7-SB143	X7-SB144	X7-SB144	X7-SB145	X7-SB146	X7-SB147	X7-SB148
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1400002	X7SS1410002	X7SS1420002	X7SS1430002	X7SS1430002D	X7SS1440002	X7SS1440002D	X7SS1450002	X7SS1460002	X7SS1470002	X7SS1480002
sample_dat	20071006	20071006	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate					X7SS1430002		X7SS1440002				
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_155	c_156	c_157	c_158	c_159	c_160	c_161	c_162	c_163	c_164	c_165
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM											13700
ANTIMONY											1.2 J
ARSENIC											7.41
BARIUM											153
BERYLLIUM											0.859
CADMIUM											1.32
CALCIUM											5560
CHROMIUM											18.7
COBALT											15.3
COPPER											26.6
IRON											22400
LEAD											71.8
MAGNESIUM											2100
MANGANESE											1320
NICKEL											21.4
POTASSIUM											1730
SELENIUM											0.661
SILVER											0.0984
SODIUM											106 U
THALLIUM											0.18
VANADIUM											28.1
ZINC											58.5
XRF Lead (mg/kg)											
LEAD	40.5	31	30.67	41.67	36.67	0 U	33	61.67	39.33	71	148

order	166	167	168	169	170	171	172	173	174	175	176
nsample	X7SS1490002	X7SS1500002	X7SS1510002	X7SS1520002	X7SS1530002	X7SS1540002	X7SS1550002	X7SS1550002-D	X7SS1560002	X7SS1570002	X7SS1580002
location	X7-SB149	X7-SB150	X7-SB151	X7-SB152	X7-SB153	X7-SB154	X7-SB155	X7-SB155	X7-SB156	X7-SB157	X7-SB158
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1490002	X7SS1500002	X7SS1510002	X7SS1520002	X7SS1530002	X7SS1540002	X7SS1550002	X7SS1550002D	X7SS1560002	X7SS1570002	X7SS1580002
sample_dat	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate								X7SS1550002			
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_166	c_167	c_168	c_169	c_170	c_171	c_172	c_173	c_174	c_175	c_176
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM				12800							
ANTIMONY				6.1 J							
ARSENIC				7.84							
BARIUM				134							
BERYLLIUM				0.888							
CADMIUM				1.25							
CALCIUM				18000							
CHROMIUM				23							
COBALT				17.3							
COPPER				66.3							
IRON				27300							
LEAD				460							
MAGNESIUM				5840							
MANGANESE				1280							
NICKEL				26.6							
POTASSIUM				1550							
SELENIUM				0.717							
SILVER				0.105							
SODIUM				68.9 U							
THALLIUM				0.169							
VANADIUM				31.2							
ZINC				72.9							
XRF Lead (mg/kg)											
LEAD	55.33	30.33	28.67	247.33	71.67	25	25.67	33	27	41.33	27

order	177	178	179	180	181	182	183	184	185	186	187
nsample	X7SS1590002	X7SS1600002	X7SS1610002	X7SS1620002	X7SS1630002	X7SS1640002	X7SS1650002	X7SS1660002	X7SS1670002	X7SS1680002	X7SS1690002
location	X7-SB159	X7-SB160	X7-SB161	X7-SB162	X7-SB163	X7-SB164	X7-SB165	X7-SB166	X7-SB167	X7-SB168	X7-SB169
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1590002	X7SS1600002	X7SS1610002	X7SS1620002	X7SS1630002	X7SS1640002	X7SS1650002	X7SS1660002	X7SS1670002	X7SS1680002	X7SS1690002
sample_dat	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate											
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_177	c_178	c_179	c_180	c_181	c_182	c_183	c_184	c_185	c_186	c_187
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM									18400		
ANTIMONY									0.73 J		
ARSENIC									10.6		
BARIUM									138		
BERYLLIUM									1.13		
CADMIUM									1.79		
CALCIUM									3100		
CHROMIUM									28.6		
COBALT									17.8		
COPPER									36.9		
IRON									36100		
LEAD									72.2		
MAGNESIUM									1860		
MANGANESE									934		
NICKEL									28.9		
POTASSIUM									2380		
SELENIUM									0.81		
SILVER									0.144		
SODIUM									75.8 U		
THALLIUM									0.205		
VANADIUM									37.4		
ZINC									86.4		
XRF Lead (mg/kg)											
LEAD	24.5	30.67	73	194.33	71.67	133.33	128.67	50.67	101	41.67	18

order	188	189	190	191	192	193	194	195	196	197	198
nsample	X7SS1700002	X7SS1710002	X7SS1730002	X7SS1740002	X7SS1750002	X7SS1760002	X7SS1770002	X7SS1780002	X7SS1790002	X7SS1800002	X7SS1810002
location	X7-SB170	X7-SB171	X7-SB173	X7-SB174	X7-SB175	X7-SB176	X7-SB177	X7-SB178	X7-SB179	X7-SB180	X7-SB181
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1700002	X7SS1710002	X7SS1730002	X7SS1740002	X7SS1750002	X7SS1760002	X7SS1770002	X7SS1780002	X7SS1790002	X7SS1800002	X7SS1810002
sample_dat	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate											
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_188	c_189	c_190	c_191	c_192	c_193	c_194	c_195	c_196	c_197	c_198
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM			10900	10600	9300		15200	15500	11500	16200	14800
ANTIMONY			3.7 J	12.3 J	3.3 J		2.6 J	0.98 J	2.0 J	2.1 J	5.3 J
ARSENIC			11.5	8.8	15.2		10.8	8.86	11	15	8.77
BARIUM			91.4	87.9	90.6		59.9	82.8	56.2	81.8	118
BERYLLIUM			0.95	0.741	0.905		0.78	0.594	0.769	0.827 J	1.2
CADMIUM			1.26	1.34	2.21		0.993	0.969	0.439	1.32	0.572
CALCIUM			1350	1420	1430		1330	1360	1110	1020	1080
CHROMIUM			20.7	19.1	18.1		57	30.1	39.2	32.2	45.9
COBALT			12.9	14.3	17.6		15	20.8	14.4	19.2	11.2
COPPER			30.8	98.7	59.7		48.1	16.9	29.2	51.9	63.8
IRON			44000	20900	51900		45000	30600	38400	31500	35800
LEAD			125	430	170		115	40.9	83.6	89	212
MAGNESIUM			1160	1040	723		1580	1420	1190	2280	1810
MANGANESE			1060	912	1310		502	821	637	544	571
NICKEL			22.6	19.1	25.9		17.3	16.3	13.6	27	32.4
POTASSIUM			754	782	768		882	884	592	1210	715
SELENIUM			0.631	0.546	0.743		0.365	0.43	0.322	0.604	0.279
SILVER			0.136	0.165	0.141		0.0996	0.0894	0.0593	0.186	0.062
SODIUM			83.9 U	58.5 U	31.1 U		50.1 U	43.9 U	23.8 U	138	19.1 U
THALLIUM			0.162	0.158	0.141		0.175	0.18	0.147	0.39	0.133
VANADIUM			38.9	27.2	31		44.1	39.8	35.9	78	73.2
ZINC			61	64	118		53.1	40.7	42.2	74.8	96.5
XRF Lead (mg/kg)											
LEAD	237.67	24.33	121.33	442.33	96	147.33	114.67	29.67	104	84.67	202.33

order	199	200	201	202	203	204	205	206	207
nsample	X7SS1820002	X7SS1830002	X7SS1840002	X7SS1850002	X7SS1860002	X7SS1870002	X7SS1880002	X7SS1890002	X7SS1900002
location	X7-SB182	X7-SB183	X7-SB184	X7-SB185	X7-SB186	X7-SB187	X7-SB188	X7-SB189	X7-SB190
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1820002	X7SS1830002	X7SS1840002	X7SS1850002	X7SS1860002	X7SS1870002	X7SS1880002	X7SS1890002	X7SS1900002
sample_dat	20071007	20071007	20071007	20071009	20071009	20071009	20071009	20071009	20071009
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate									
top_depth	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_199	c_200	c_201	c_202	c_203	c_204	c_205	c_206	c_207
Semivolatile Organics (ug/kg)									
2-METHYLNAPHTHALENE									
ACENAPHTHENE									
ACENAPHTHYLENE									
ANTHRACENE									
BENZO(A)ANTHRACENE									
BENZO(A)PYRENE									
BENZO(B)FLUORANTHENE									
BENZO(G,H,I)PERYLENE									
BENZO(K)FLUORANTHENE									
CHRYSENE									
DIBENZO(A,H)ANTHRACENE									
FLUORANTHENE									
FLUORENE									
INDENO(1,2,3-CD)PYRENE									
NAPHTHALENE									
PHENANTHRENE									
PYRENE									
Inorganics (mg/kg)									
ALUMINUM	11700	19400	15600					10000	
ANTIMONY	2.8 J	0.59 U	0.38 U					2.6 J	
ARSENIC	15.1	17	12.5					5.52	
BARIUM	61.5	92.9	73.7					82.8	
BERYLLIUM	0.703 J	0.718 J	0.625 J					0.86	
CADMIUM	0.823	1.9	1.32					0.815	
CALCIUM	1040	18700	1790					1130	
CHROMIUM	35.2	28.5	21.1					16.7	
COBALT	22.8	16.9	18.6					13.3	
COPPER	44.2	48.2	33.8					46.3	
IRON	45700	29700	24700					23200	
LEAD	95.1	28.8	25.3					151	
MAGNESIUM	1140	3910	2620					1020	
MANGANESE	641	334	477					665	
NICKEL	22.1	29.7	24.3					19.6	
POTASSIUM	810	1740	1180					660	
SELENIUM	0.373	0.913	0.367					0.383	
SILVER	0.0985	0.238	0.152					0.126	
SODIUM	40.9	138	93.5					64.7 U	
THALLIUM	0.224	0.525	0.394					0.128 U	
VANADIUM	57	85.9	64.3					25.6	
ZINC	47	74.3	61					61.8	
XRF Lead (mg/kg)									
LEAD	109	24.67	25.67	24.33	32	21	23.67	165.67	334.67

APPENDIX D

STATISTICAL EVALUATION

Figure 1 is a scatterplot of the natural log of the Average XRF Lead results and the natural log of the Laboratory lead results for each sample. The natural log is used in this case due to the violation of the statistical assumption of constant variance for the regression analysis preformed later on. The natural log transformed data do not violate this assumption. From the scatterplot a strong positive linear trend is evident.

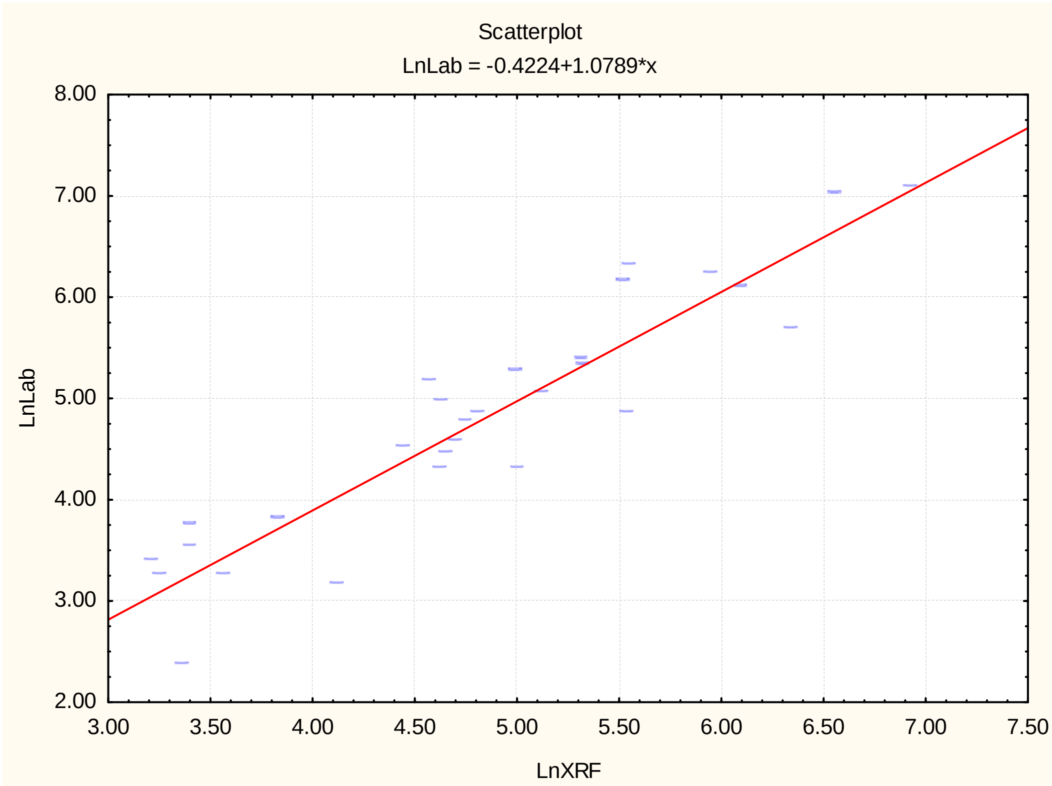


Figure 1

After inspecting the scatterplot to verify linearity, the Pearson correlation, r, for these results was calculated. The Pearson correlation is a measure of the strength of the linear relationship between two or more variables with a range of -1 to +1. The value of exactly -1 represents a perfect negative correlation (as one variable decreases the other increases proportionally) whereas a value of exactly +1 represents a perfect positive correlation (as one variable increases the other increases proportionally). A value of exactly 0 represents a lack of correlation. The correlation for this analysis is 0.93 and is statistically significant at the 0.05 significance level.

Next, Ordinary Least Squares (OLS) was performed. First the assumption of constant variance of the residuals was examined. Figure 2 is a plot of the residuals of the log-transformed data. From this plot it can be seen that there is a constant variance across all concentrations.

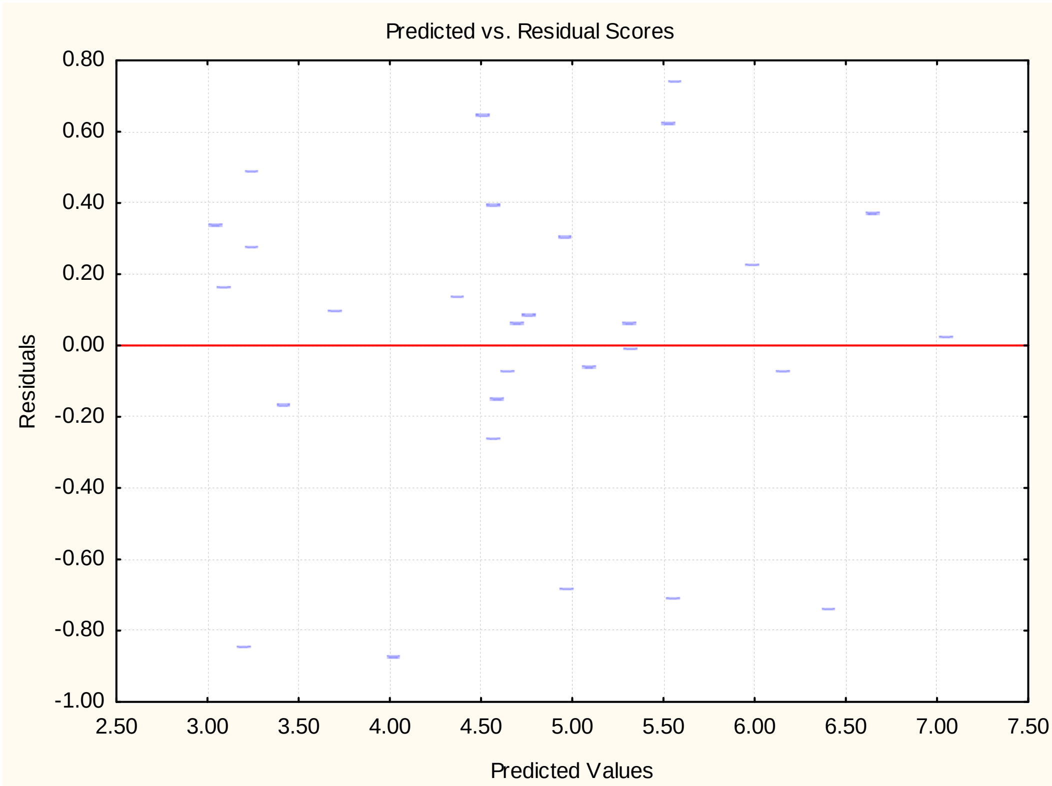


Figure 2

Next, the distribution of the residuals was inspected. Figure 3 is a Normal probability plot of the residuals. From this plot it can be seen that the residuals are nearly Normal (perfect Normality would be indicated by all points falling exactly on the straight line).

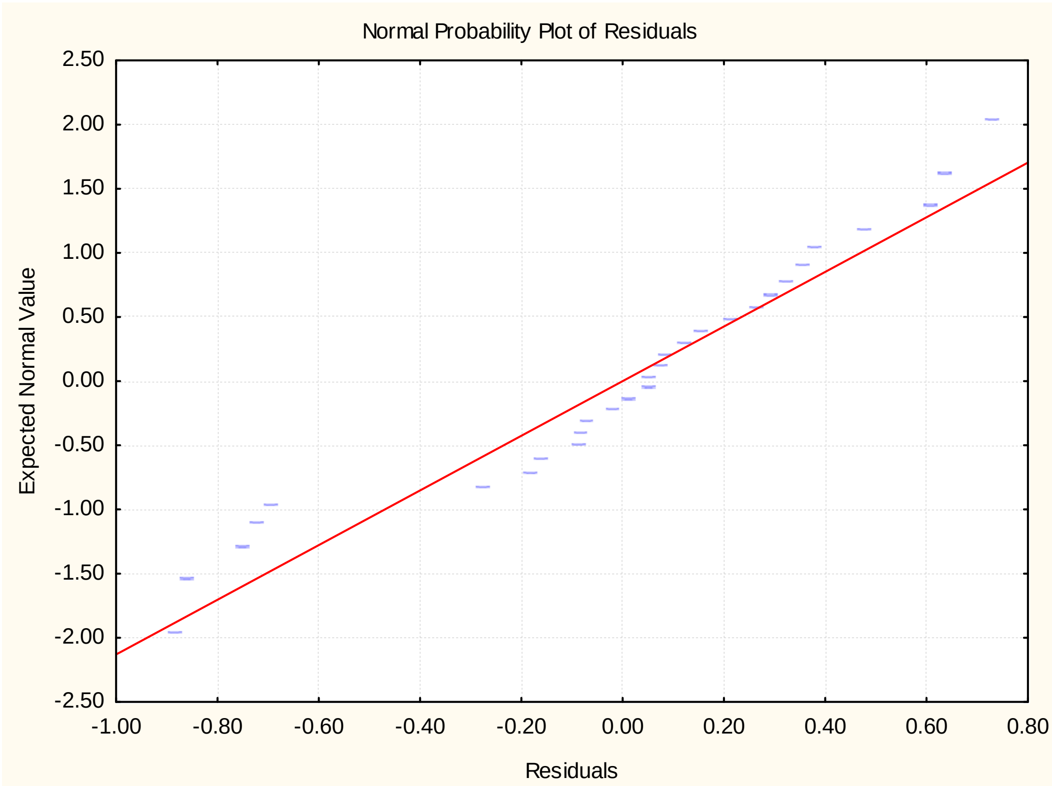


Figure 3

Having demonstrated that the log-transformed data adhere to the underlying statistical assumptions, a linear regression was computed. Table 1 contains the results of the linear regression. From this table it can be seen that the regression results are significant at the 0.05 level (i.e., p=0.0000). The p-value is the probability that the observed linear regression would occur by chance alone. A value of exactly 0 indicates that there is no chance the observed correlation is an accident and a value greater than 0.05 indicates that there is at least a 1-in-20 chance that the observed regression would be observed. In addition, the R-squared value is 86 percent. This value represents the percent of variation in natural log of lead values that can be explained by the regression model is 86 percent. An R-Squared value greater than about 80 percent is considered to indicate a very strong relationship between the two measurement methods. The maximum possible value is 100 percent.

Multiple Regression Results			
Dependent: LnLab	Multiple R =0.929	R^2=0.863	
	df=1,27	No. of cases:29	p= 0.000000
Intercept:-0.422353348	Std.Error:0.447728181	t(27) = -1.044	p=0.3058

Table 1

In summary, a very strong correlation between field XRF and laboratory lead analyses has been demonstrated.

Table 12 contains the descriptive statistics for calcium for UXO 7. From this table it can be seen that the mean concentrations are fairly similar but that there is a much larger difference between the median concentrations.

Variable	Descriptive Statistics UXO 7B							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Calcium Site	29	4381.90	1430.00	735.00	26700.00	1110.00	3720.00	6423.81
Calcium Background	8	4821.13	397.00	286.00	35300.00	318.50	776.00	12317.33

Table 12

Figures 28 and 29 contain the side by side box plots for calcium for UXO 7. From these plots it can be seen that the site calcium distribution is higher than the background calcium distribution. The Lower Quartile for the site data is higher than the Upper Quartile of the background data.

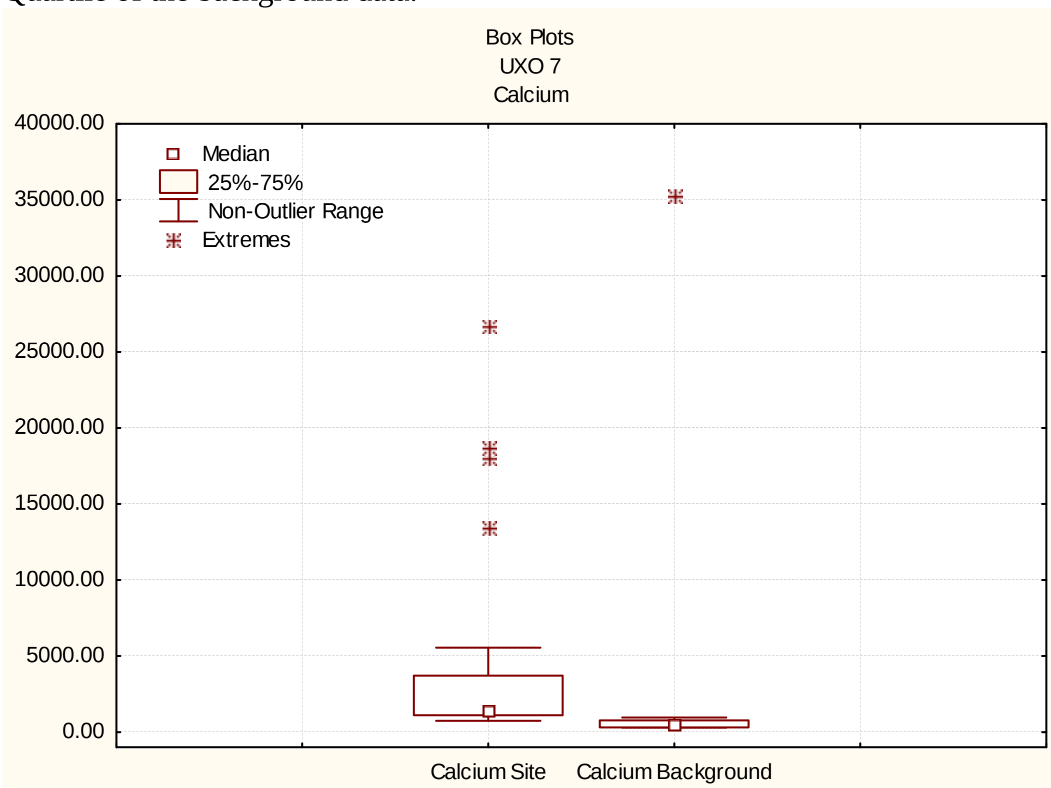


Figure 28

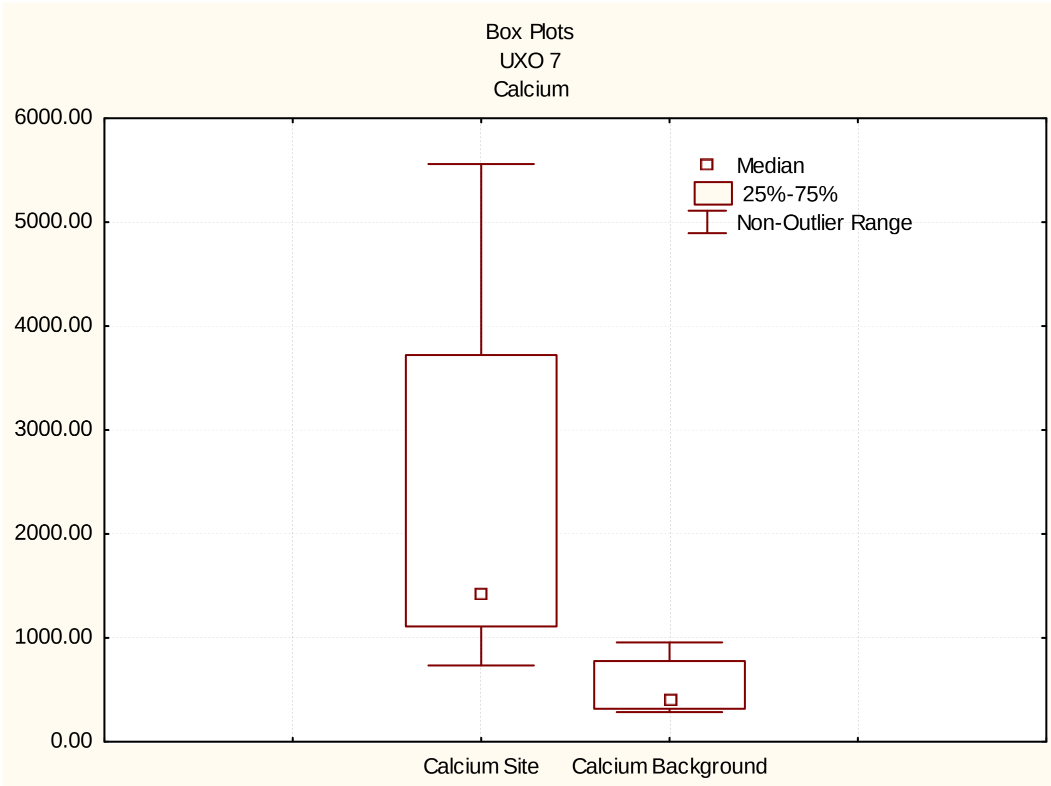


Figure 29

Figure 30 contains the side by side means plots for calcium for UXO 7. From this plot it can be seen that the mean concentrations are at roughly the same concentration. It can also be seen that the UCL for the background concentration is higher than the site concentrations.

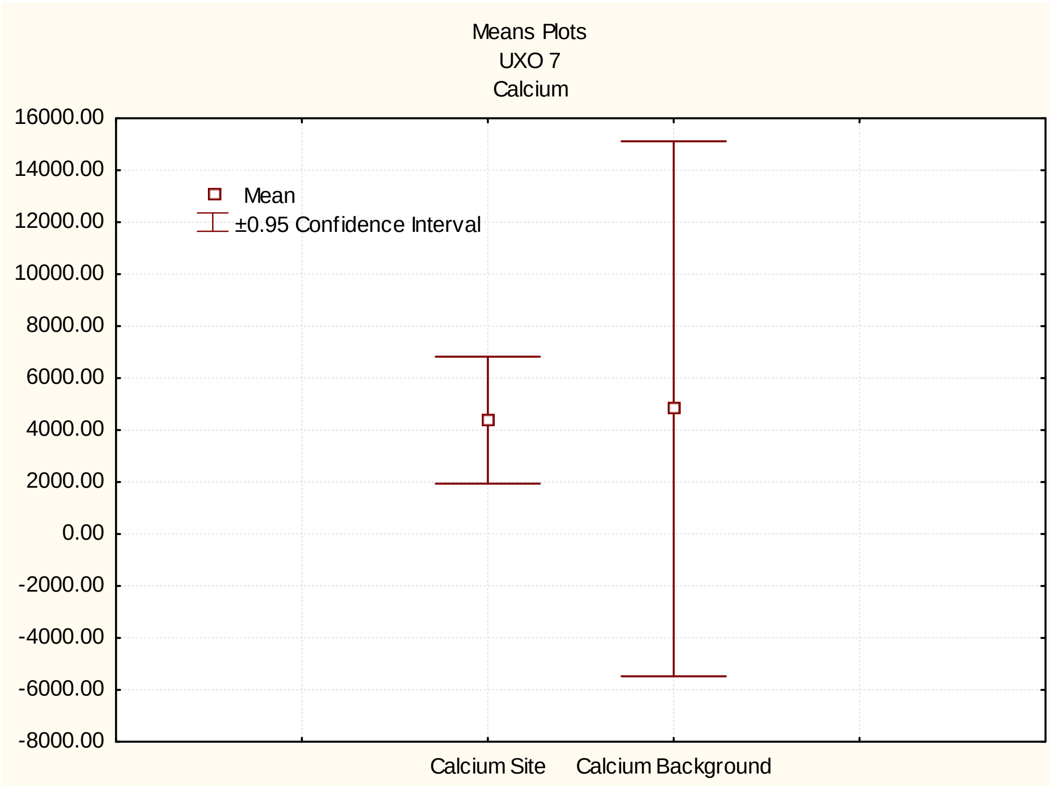


Figure 30

Figure 30 and 31 show the normal probability plots for the calcium background and site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 30 it can be seen that the background data does not roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.00. Therefore it is concluded that the calcium background data is not normally distributed. From Figure 31 it can be seen that the site data does not roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.00. Therefore it is concluded that the calcium site data is not normally distributed.

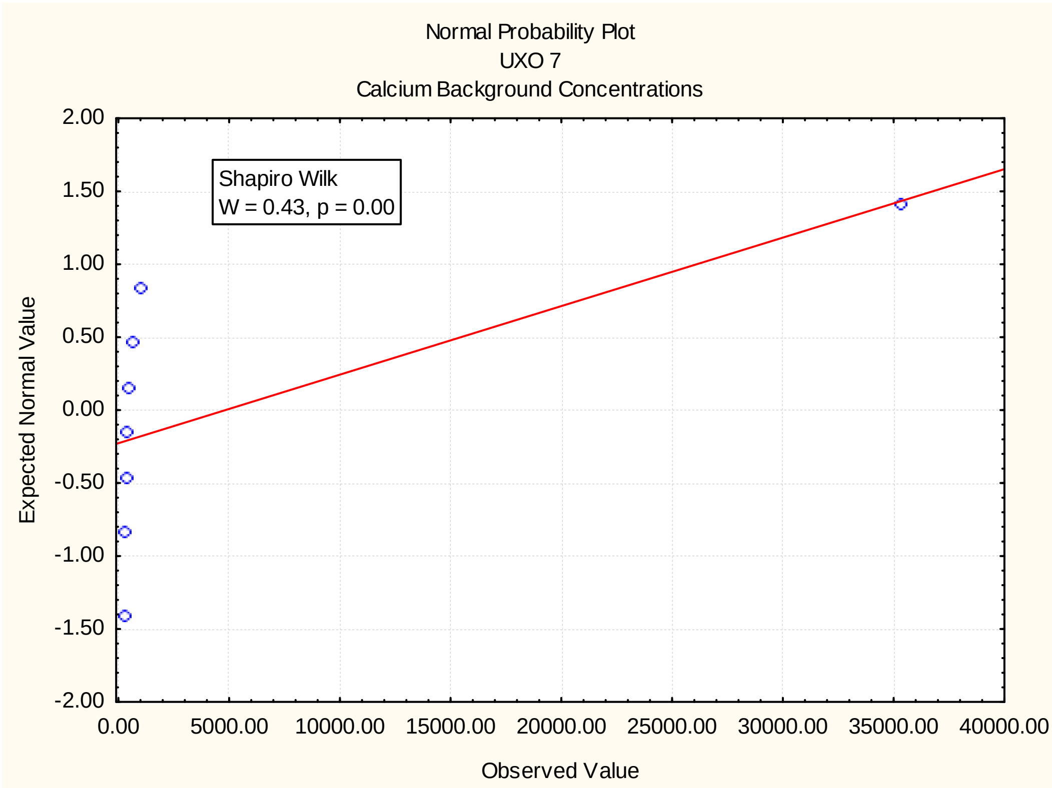


Figure 30

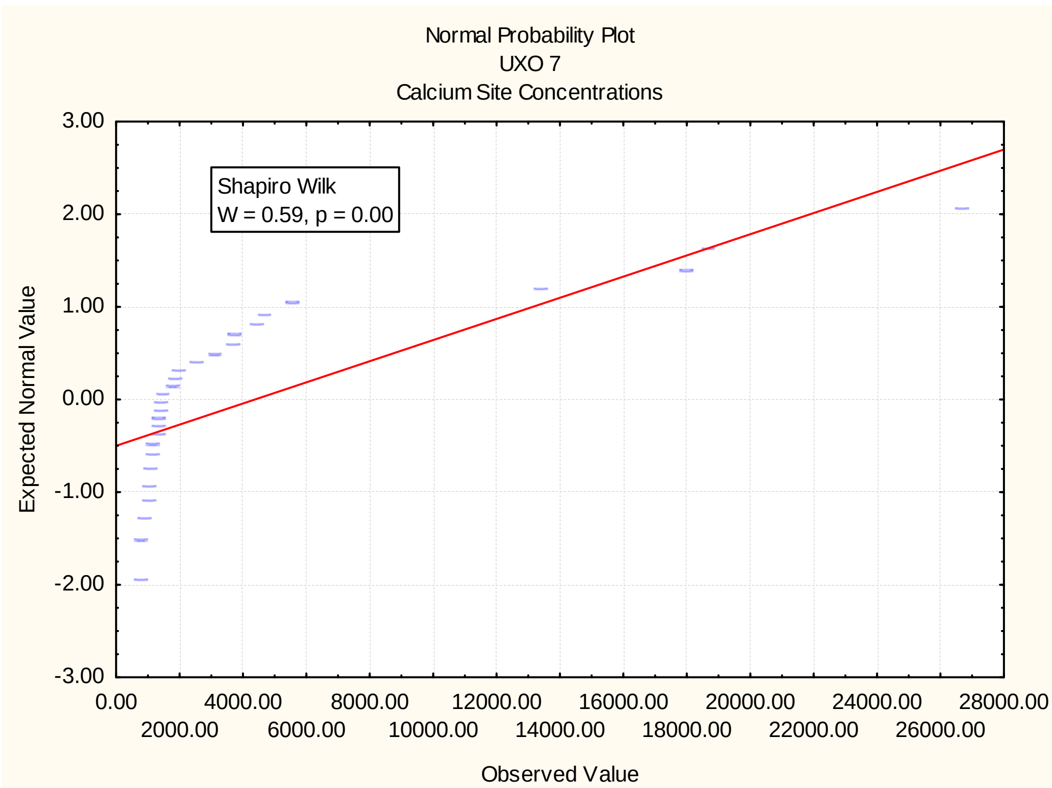


Figure 31

After examining the descriptive statistics, side by side box plots, means plots, and normality plot it can be concluded that the site calcium concentrations are greater than the background calcium concentrations.

Table 13 contains the descriptive statistics for chromium for UXO 7. From this table it can be seen that the mean, median, minimum, maximum, lower quartile and upper quartile site concentrations are greater than the background concentrations.

Variable	Descriptive Statistics UXO 7							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Chromium Site	29	26.94	23.40	10.20	66.60	20.40	28.60	12.12
Chromium Background	8	14.05	14.05	9.20	17.80	11.65	17.00	3.15

Table 13

Figure 32 contain the side by side box plots for chromium for UXO 7. From these plots it can be seen that the site chromium distribution is higher than the background chromium distribution. The Lower Quartile for the site data is higher than the Upper Quartile of the background data.

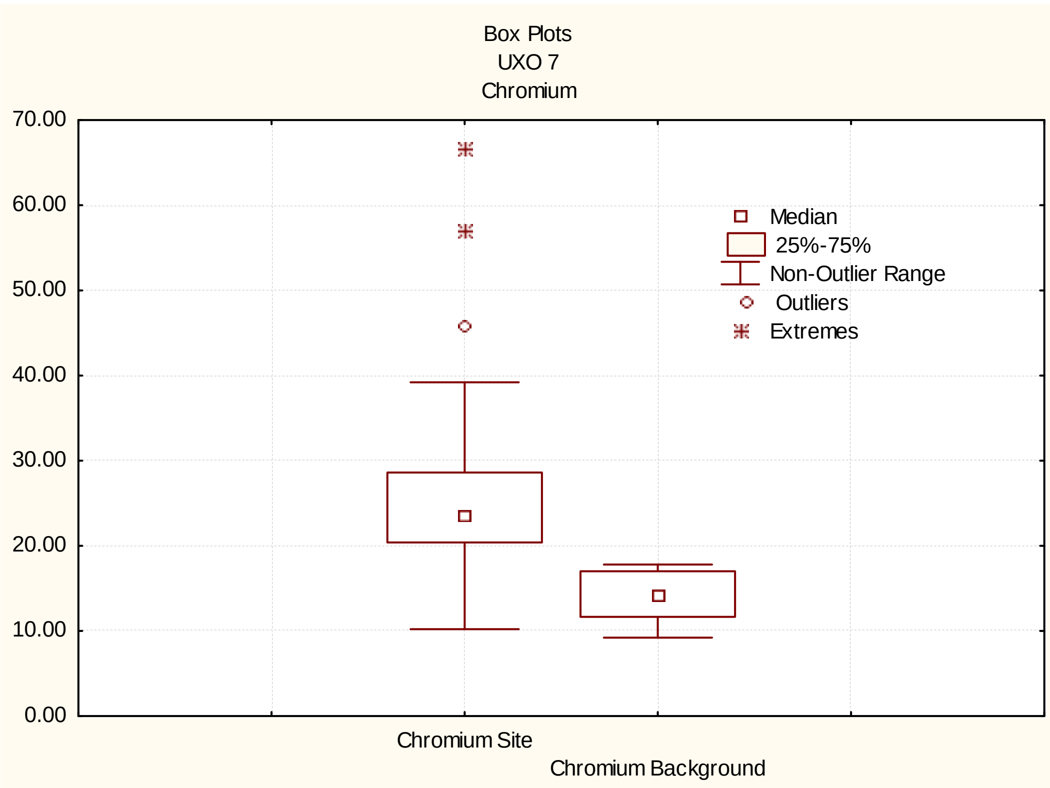


Figure 32

Figure 33 contains the side by side means plots for chromium for UXO 7. From this plot it can be seen that the site mean concentrations is higher than the background mean concentration. The LCL for the site mean is higher than the UCL for the background mean.

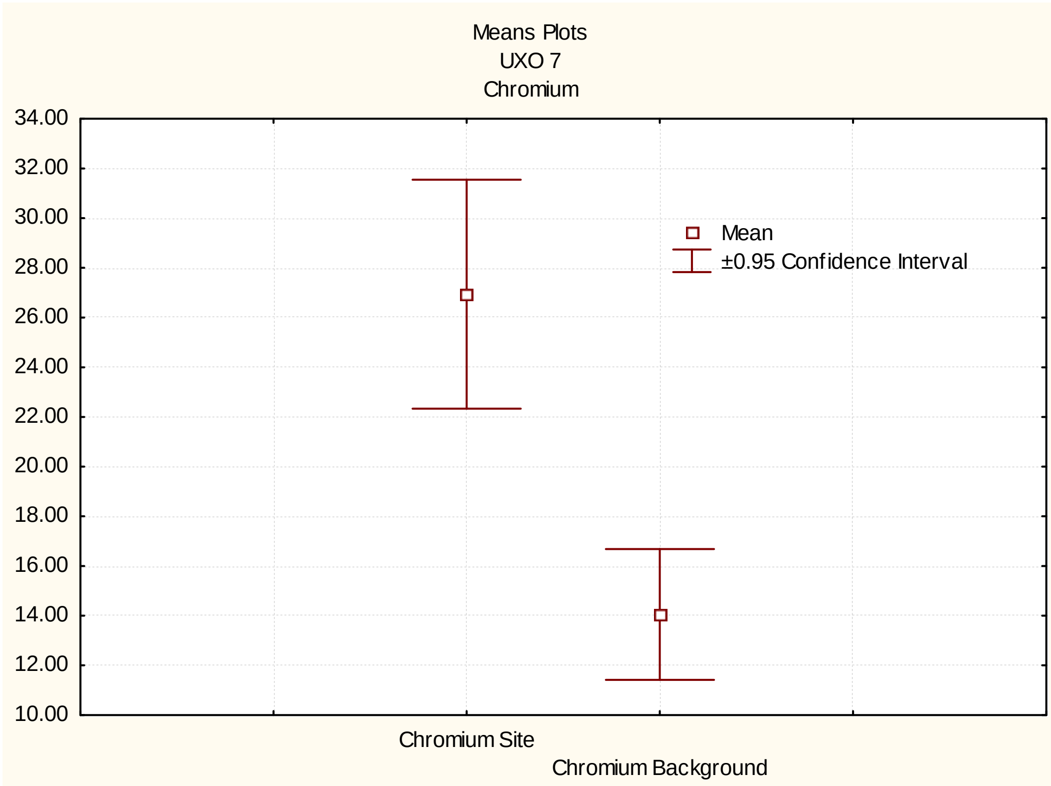


Figure 33

Figure 34 and 35 show the normal probability plots for the chromium background and site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 34 it can be seen that the background data roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.64. Therefore it is concluded that the chromium background data is normally distributed. From Figure 35 it can be seen that the site data does not roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.00. Therefore it is concluded that the chromium site data is not normally distributed.

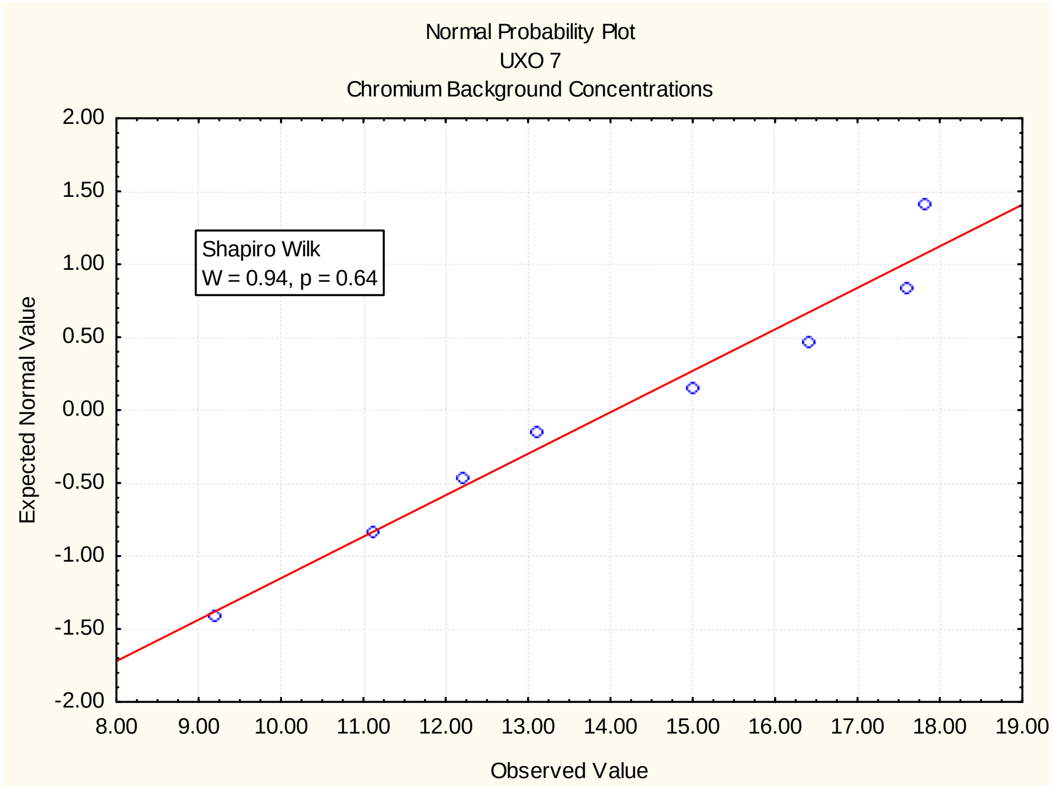


Figure 34

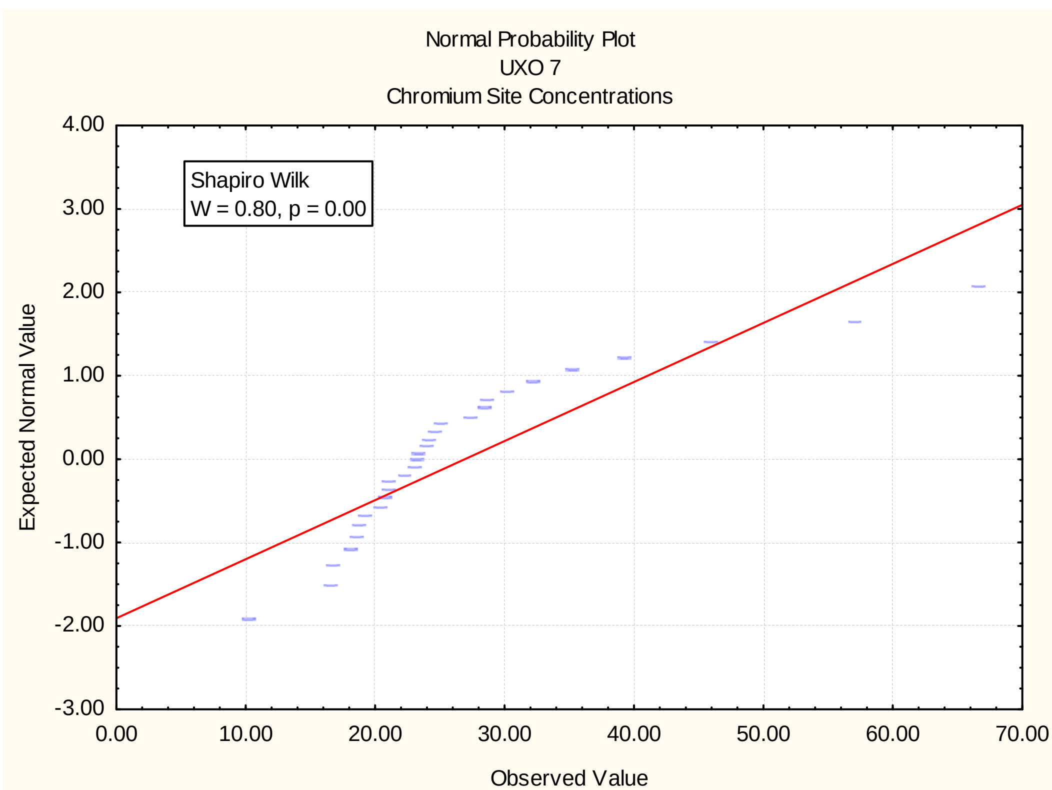


Figure 35

After examining the descriptive statistics, side by side box plots, means plots, and normality plot it can be concluded that the site chromium concentrations are greater than the background chromium concentrations.

Table 14 contains the descriptive statistics for cobalt for UXO 7. From this table it can be seen that the mean, median, lower quartile and upper quartile site concentrations are slightly greater than the background concentrations. The site minimum and maximum concentrations are lower than the background minimum and maximum concentrations.

	Descriptive Statistics UXO 7							
Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Cobalt Site	29	14.73	14.30	6.79	22.80	12.40	17.30	3.70
Cobalt Background	8	13.73	13.60	8.40	27.10	8.75	14.80	6.09

Table 14

Figure 35 contains the side by side box plots for cobalt for UXO 7. From this plot it can be seen that the site cobalt median concentration is roughly the same as the background median concentration. The Lower Quartile for the site data is higher than the Lower Quartile for the background data and the Upper Quartile for the site data is higher than the Upper Quartile of the background data.

Figure 35

Figure 36 shows the side by side means plots. From this figure it can be seen that the site mean concentration is slightly higher than the mean background concentration. It can also be seen that the confidence interval of the site data is smaller than the confidence interval for the background data.

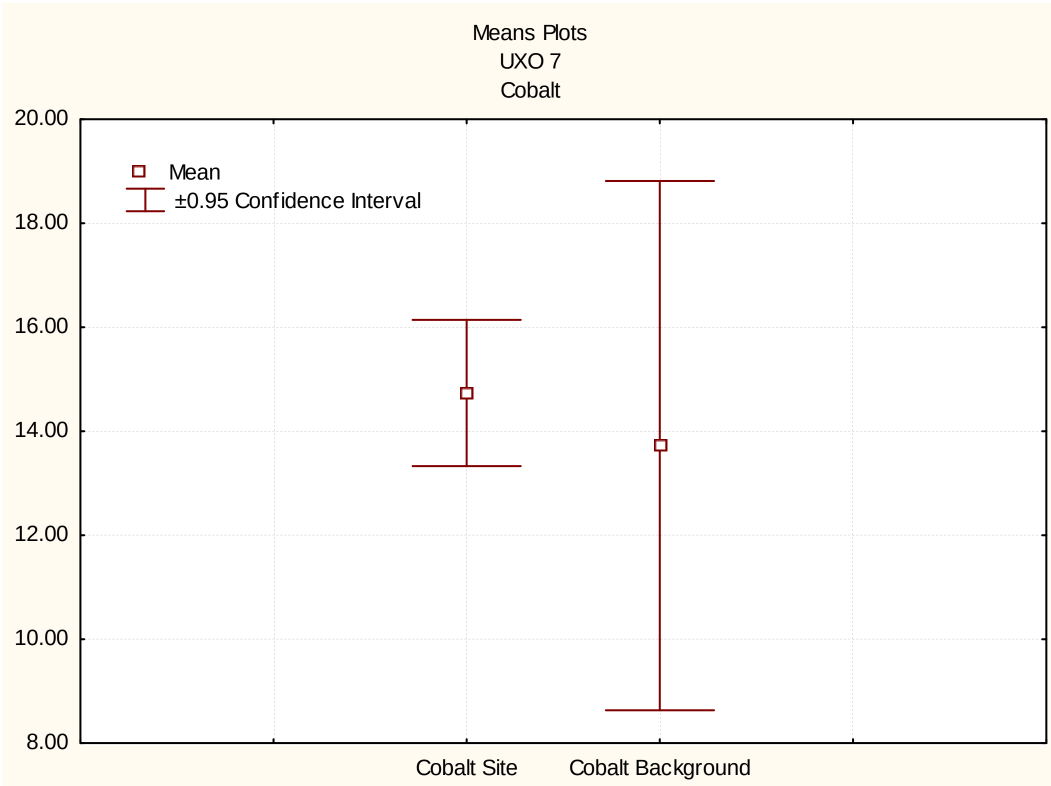


Figure 36

Figure 37 and 38 show the normal probability plots for the cobalt background and site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 37 it can be seen that the background data do not roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.03. Therefore it is concluded that the cobalt background data is not normally distributed. From Figure 38 it can be seen that the site data roughly follows the line and that the p value for the corresponding Shapiro Wilk test is 0.69. Therefore it is concluded that the cobalt site data is normally distributed.

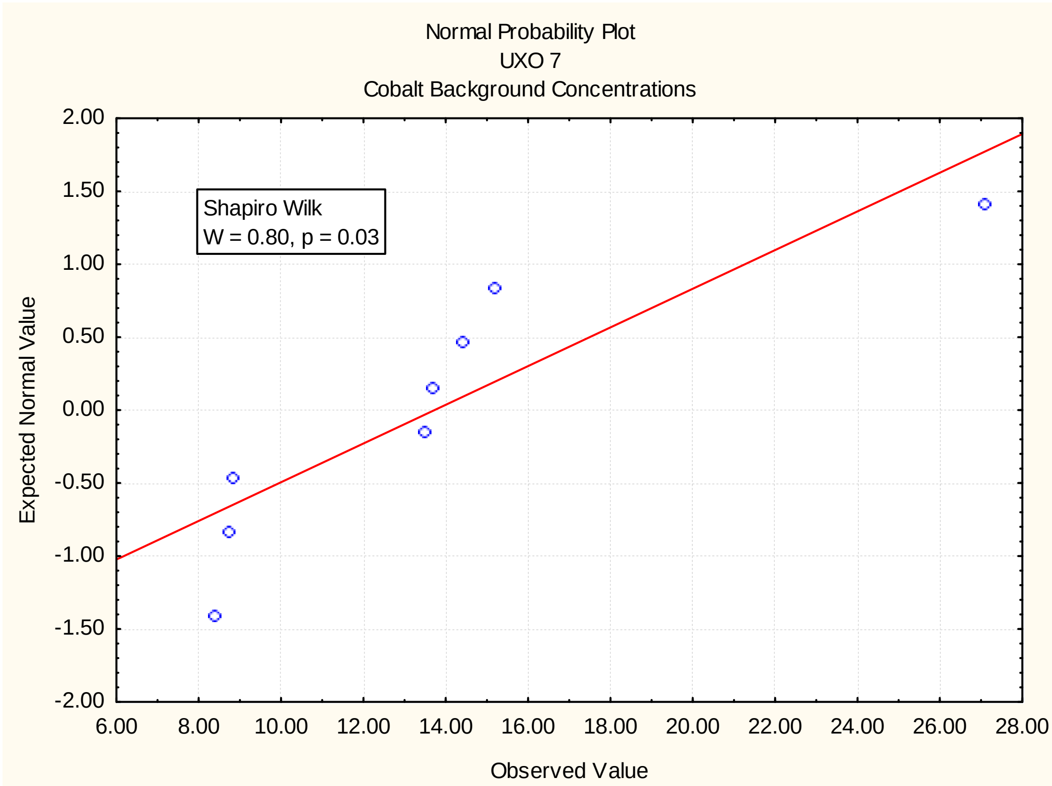


Figure 37

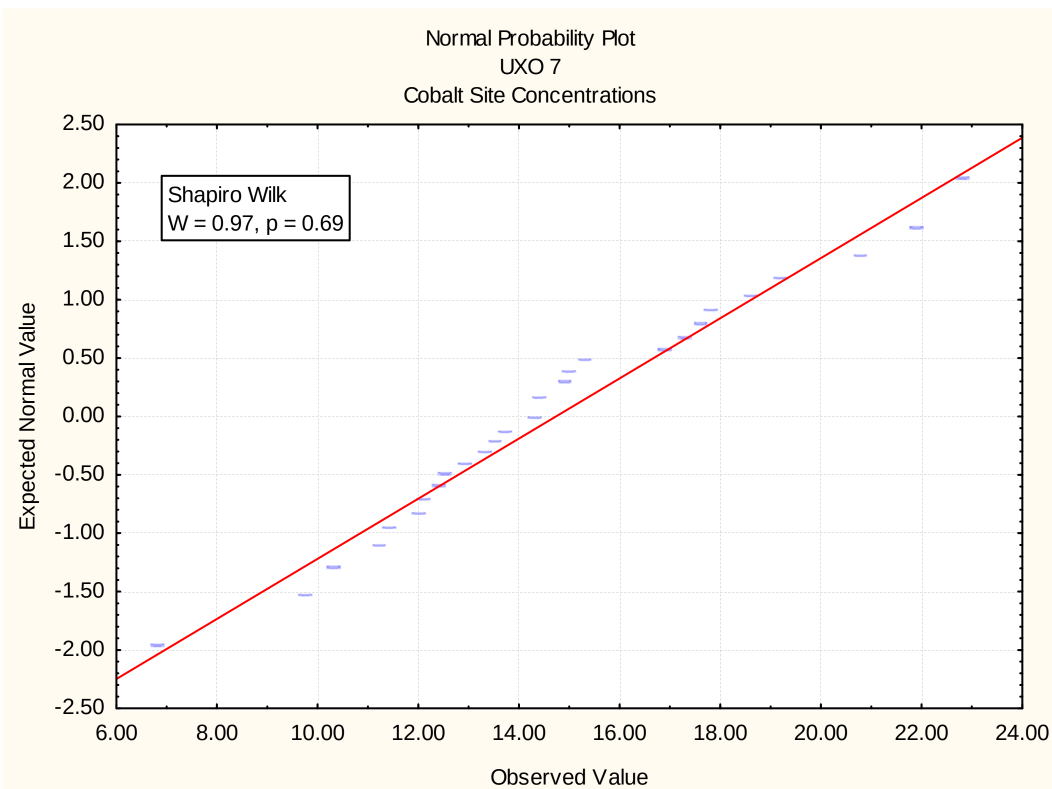


Figure 38

Table 15 contains the Test Statistic and corresponding p value for Levene's test for equality of variance. The Levene Test tests the hypothesis that the variances of the Site and Background Concentrations are equal. If the p-value for Levene's test is less than 0.05 than the variances of the distributions are not equal. From Table 15 it can be seen that the p-value for Levene's Test is 0.37 so the variances of the Site and Background Coblat Concentrations are equal.

Levene's Test	
Levene F(1,df)	.82
Degrees of freedom (df)	35
p-value	0.37

Table 15

Because the site and background concentrations are not normally distributed and the variances are equal, the Wilcoxon Rank Sum Test was used to determine if there are differences between the two data sets. The Wilcoxon Rank Sum Test tests the hypothesis that the site cobalt concentrations are equal to the background cobalt concentrations. Table 16 contains the Test Statistic and corresponding p value for the Wilcoxon Rank Sum Test, because the pvalue is greater than 0.05 we fail to reject the null that there is no difference between the background and site concentrations.

Wilcoxon Rank Sum Test	
Test Statistic	0.94
P Value	0.1736

Table 16

Table 17 contains the descriptive statistics for copper for UXO 7. From this table it can be seen that the mean, median, maximum, and lower quartile and upper quartile site concentrations are greater than the background concentrations.

	Descriptive Statistics UXO 7							
Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Copper Site	29	74.95	46.30	6.34	427.00	29.20	93.50	89.44
Copper Background	8	7.54	7.60	6.50	8.10	7.30	7.95	0.53

Table 17

Figures 39 and 40 contain the side by side box plots for copper for UXO 7. From these plots it can be seen that the lower quartile of the site copper concentrations is higher than the upper quartile for the background concentrations.

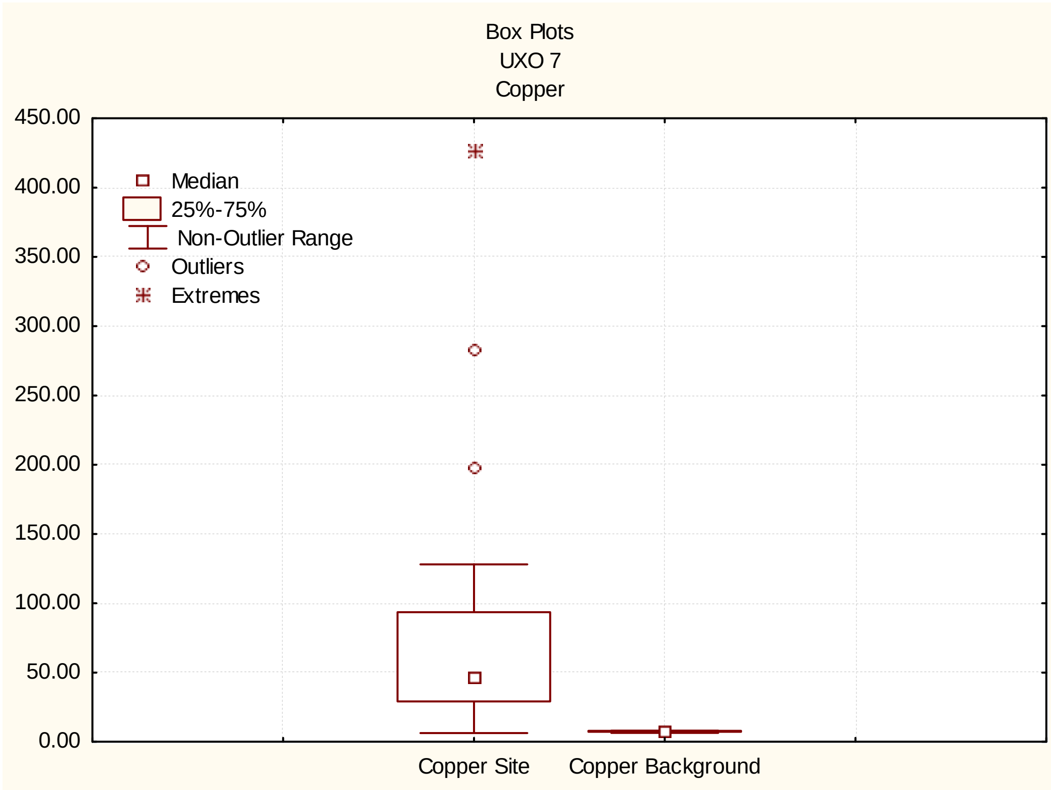


Figure 39

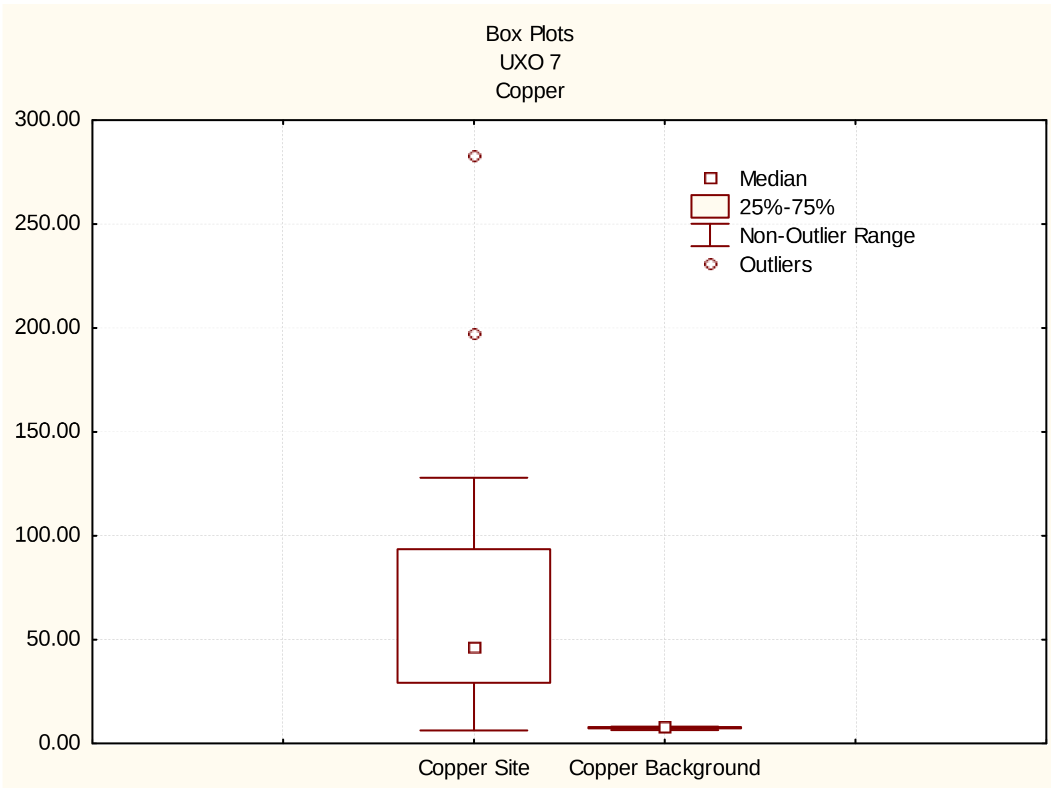


Figure 40

Figure 41 shows the side by side means plots. From this figure it can be seen that the site mean concentration is higher than the mean background concentration. The Upper Confidence limit of the background copper concentrations is less than the Lower Confidence Limit for the site copper concentrations

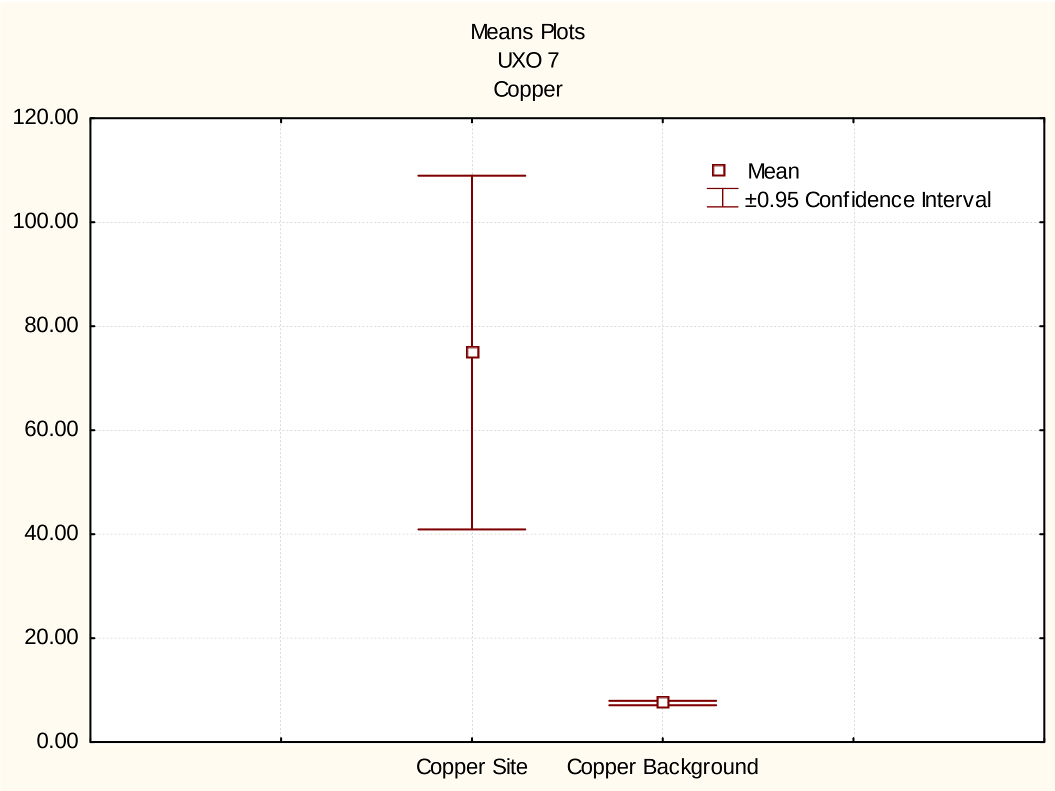


Figure 41

Figures 42 and 43 show the normal probability plots for the copper background and site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 42 it can be seen that the background roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.30. Therefore it is concluded that the copper background data is normally distributed. From Figure 43 it can be seen that the site data do not roughly follows the line and that the p value for the corresponding Shapiro Wilk test is 0.00. Therefore it is concluded that the copper site data is not normally distributed.

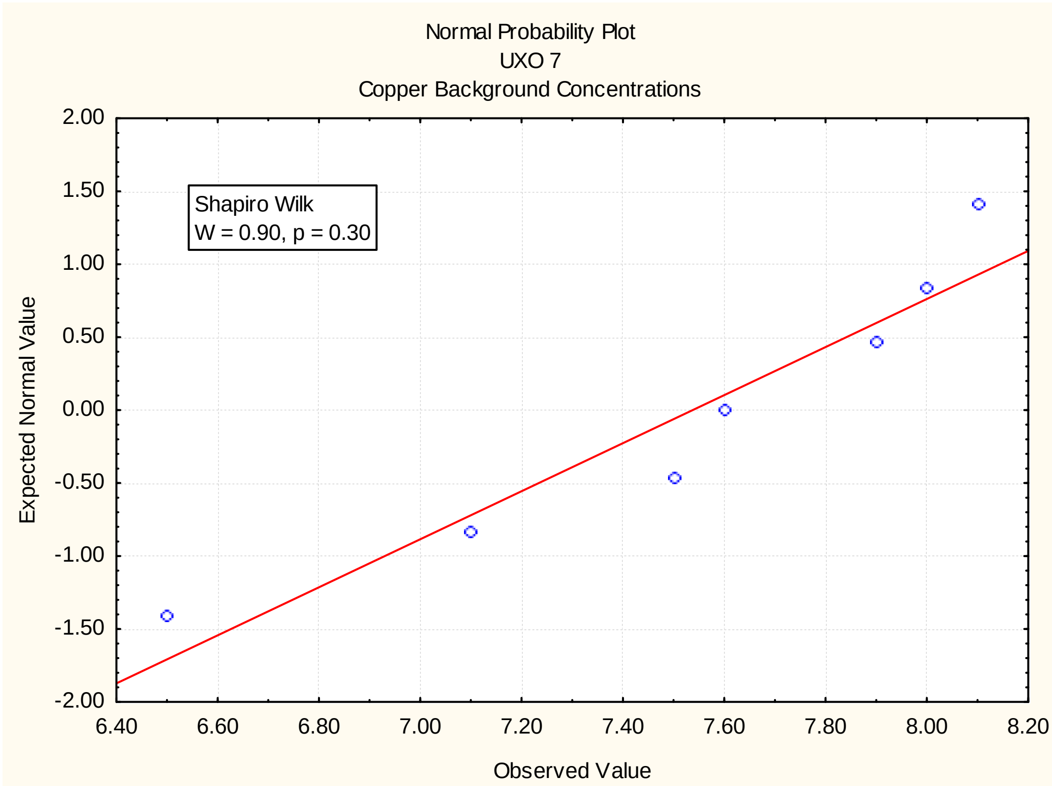


Figure 42

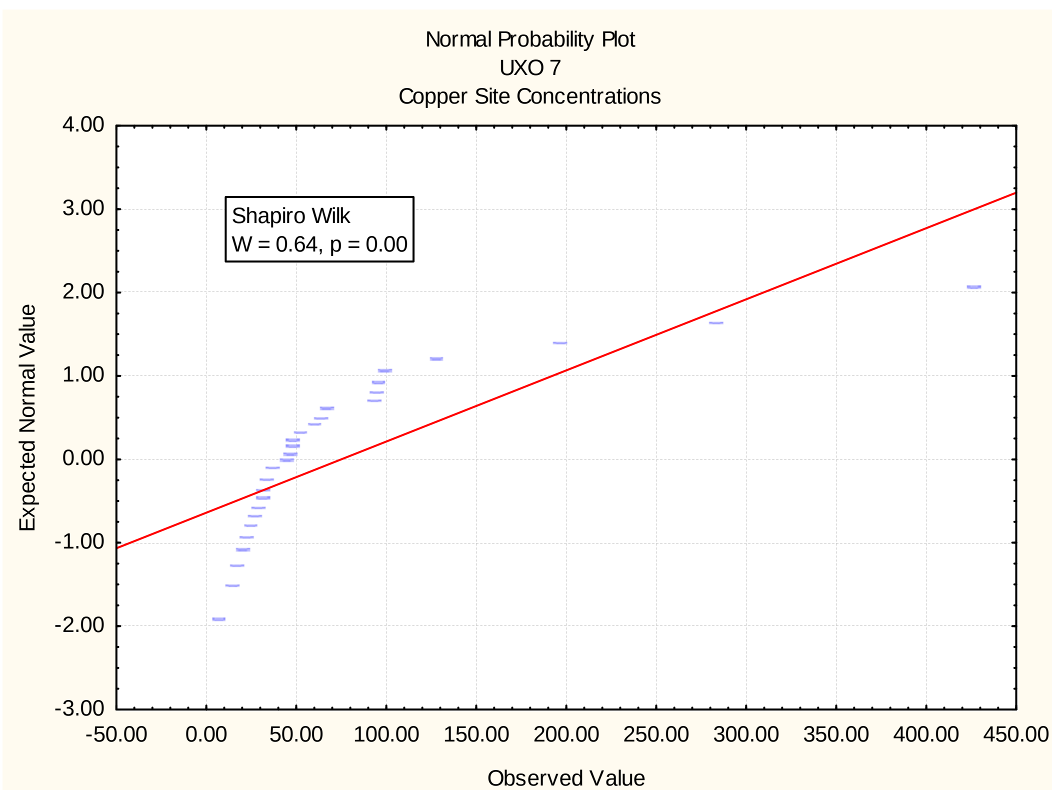


Figure 43

After examining the descriptive statistics, side by side box plots, means plots, and normality plot it can be concluded that the site copper are greater than the background copper concentrations.

Table 18 contains the descriptive statistics for iron for UXO 7. From this table it can be seen that the mean, median, minimum, maximum, and lower quartile and upper quartile site concentrations are greater than the background concentrations.

	Descriptive Statistics UXO 7							
Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Iron Site	29	33682.76	30600.00	12200.00	90700.00	#######	#######	14095.95
Iron Background	8	14267.50	14100.00	9340.00	20900.00	#######	#######	3686.72

Table 18

Figure 44 contains the side by side box plots for iron for UXO 7. From these plots it can be seen that the lower quartile of the site iron concentrations is higher than the upper quartile for the background concentrations.

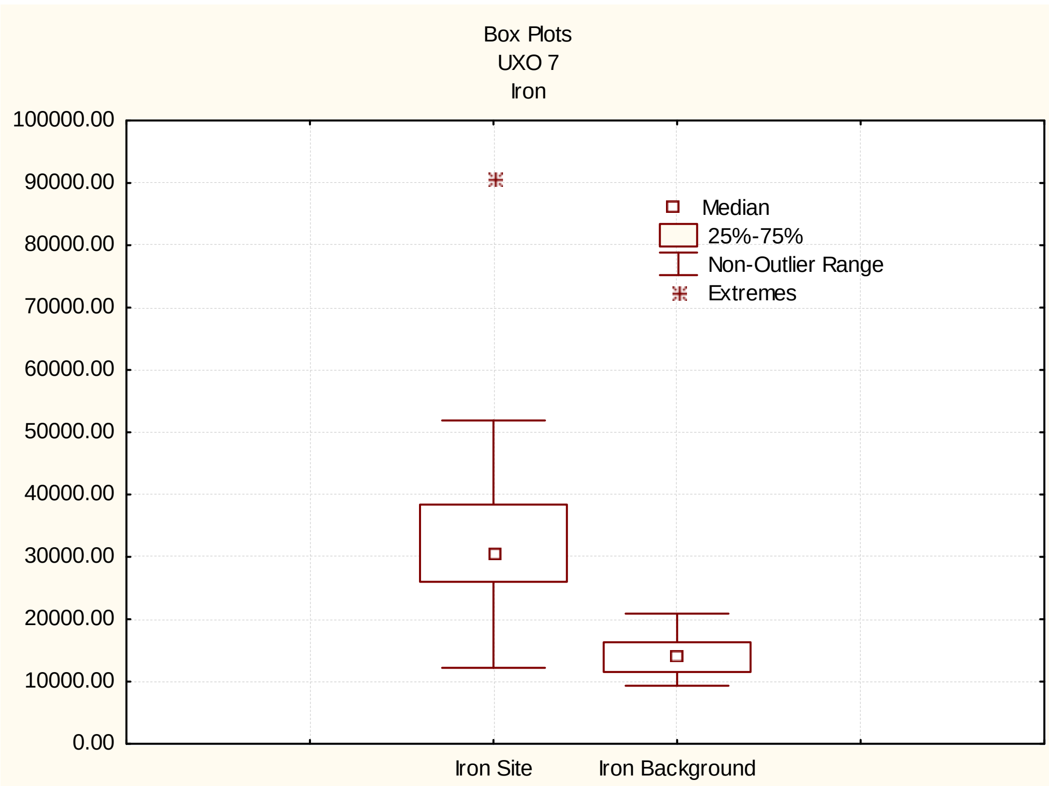


Figure 44

Figure 45 shows the side by side means plots. From this figure it can be seen that the site mean concentration is higher than the mean background concentration. The Upper Confidence limit of the background iron concentrations is less than the Lower

Confidence Limit for the site iron concentrations

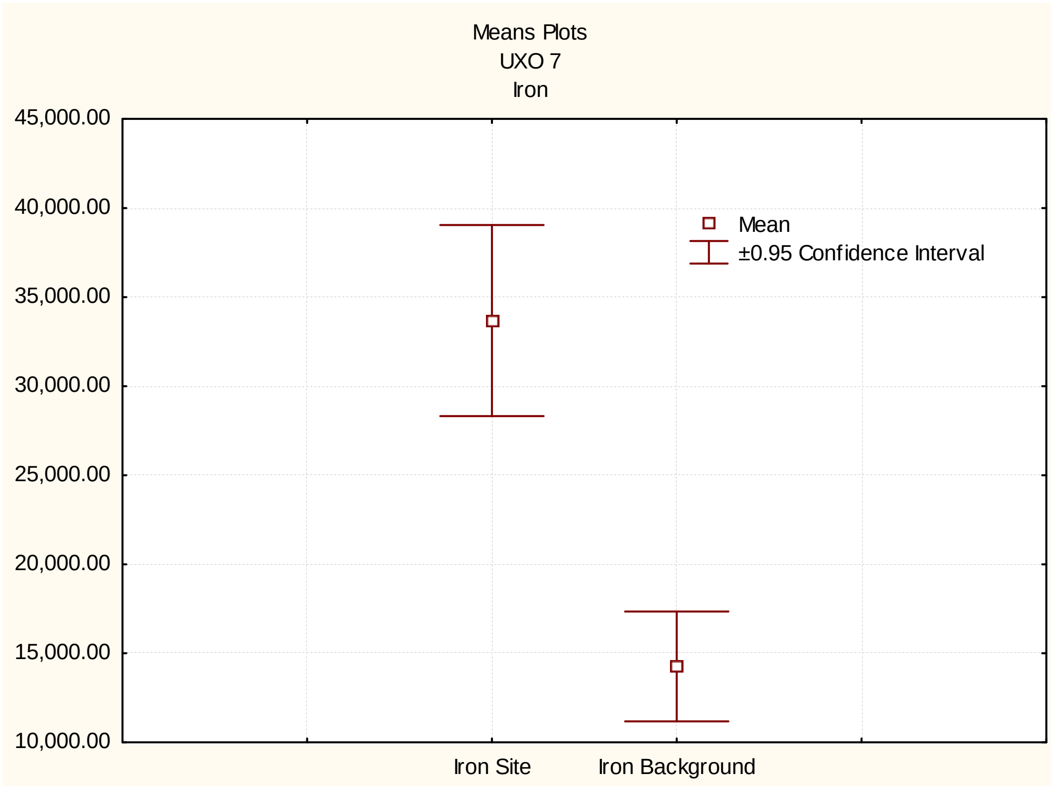


Figure 45

Figures 46 and 47 show the normal probability plots for the iron background and site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 46 it can be seen that the background roughly follows the line and that the p value for the corresponding Shapiro Wilk test is 0.94. Therefore it is concluded that the iron background data is normally distributed. From Figure 47 it can be seen that the site data do not roughly follows the line and that the p value for the corresponding Shapiro Wilk test is 0.00. Therefore it is concluded that the iron site data is not normally distributed.

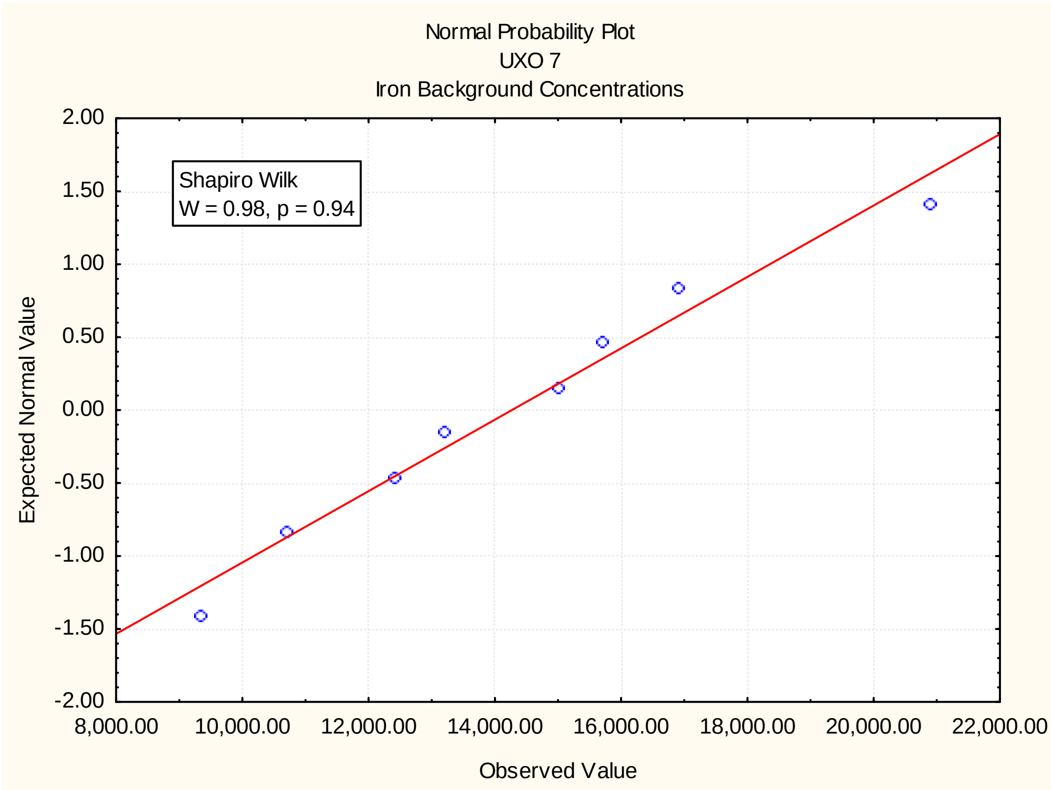


Figure 46

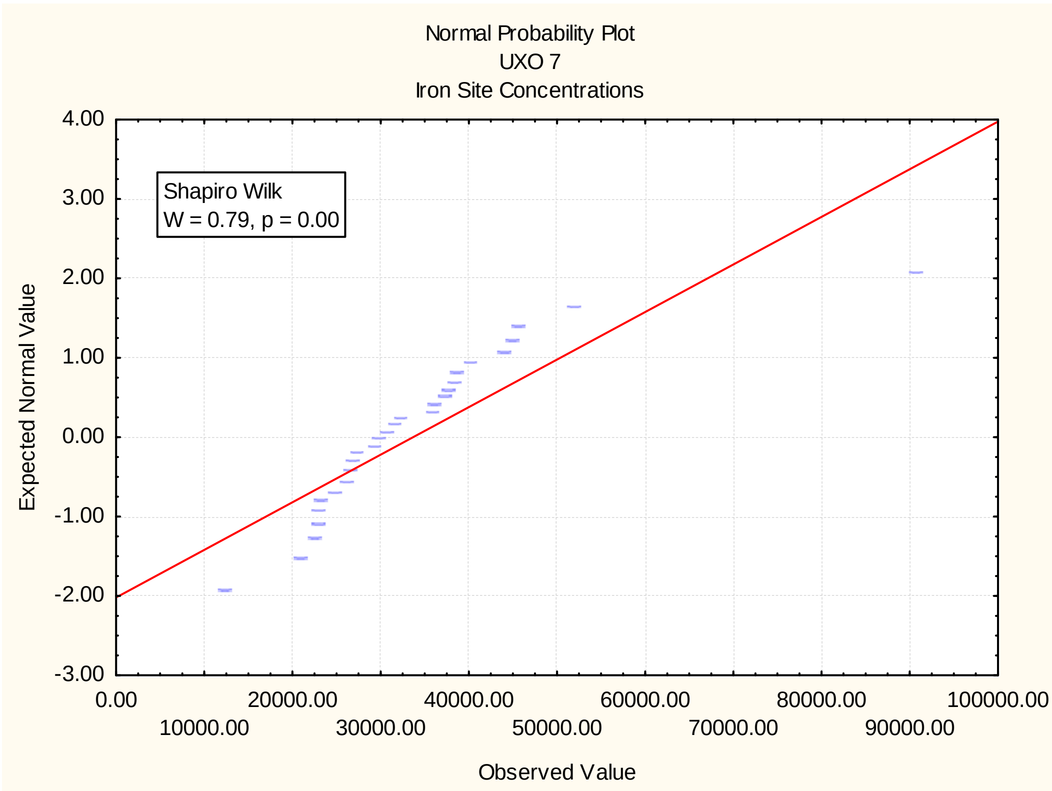


Figure 47

After examining the descriptive statistics, side by side box plots, means plots, and normality plot it can be concluded that the site iron concentrations are greater than the background iron concentrations.

Table 19 contains the descriptive statistics for lead for UXO 7. From this table it can be seen that the mean, median, maximum, and lower quartile and upper quartile site concentrations are greater than the background concentrations.

Variable	Descriptive Statistics UXO 7							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Lead Site	29	225.42	125.00	10.30	1160.00	43.90	212.00	291.05
Lead Background	8	15.89	15.45	12.30	20.60	13.25	18.40	3.10

Table 19

Figure 48 contains the side by side box plots for lead for UXO 7. From these plots it can be seen that the lower quartile of the site lead concentrations is higher than the upper quartile for the background concentrations.

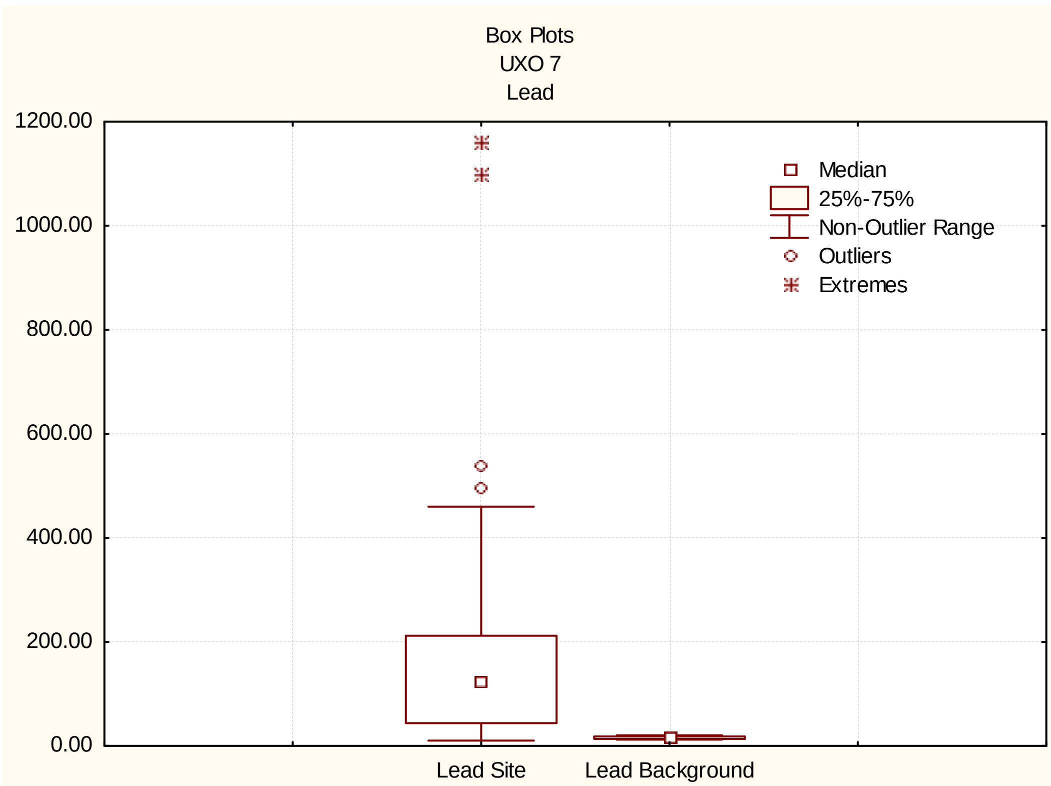


Figure 48

Figure 49 shows the side by side means plots. From this figure it can be seen that the site mean concentration is higher than the mean background concentration. The Upper Confidence limit of the background lead concentrations is less than the Lower Confidence Limit for the site lead concentrations

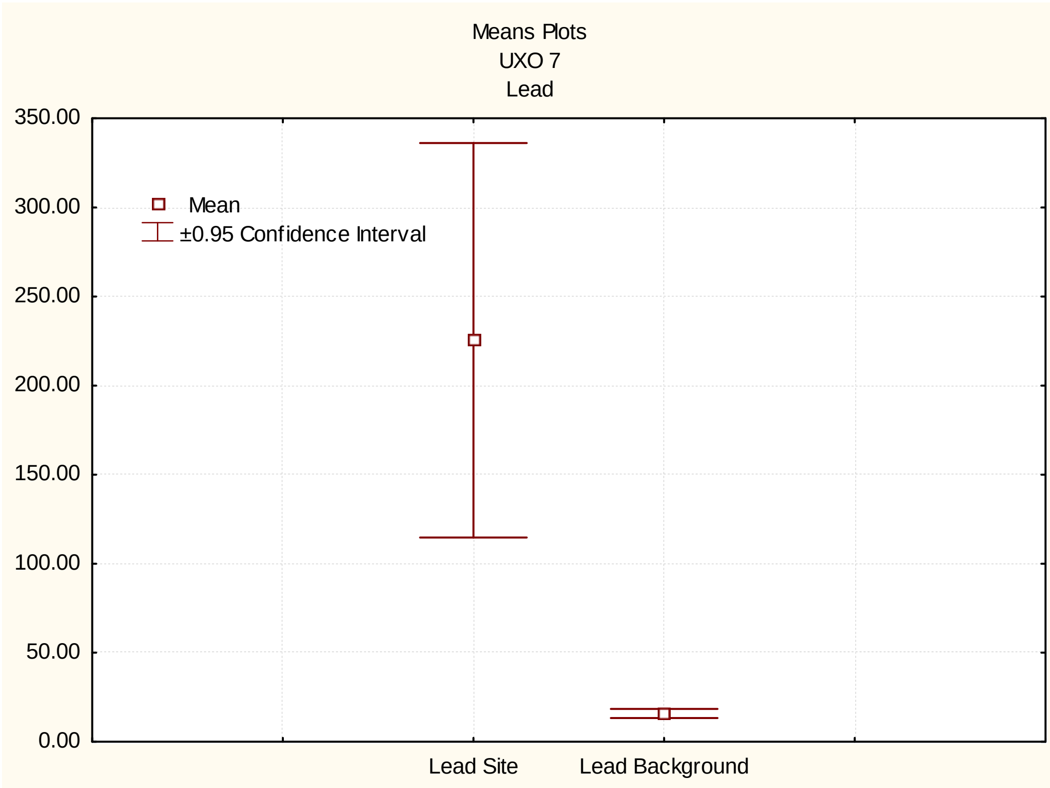


Figure 49

Figures 50 and 51 show the normal probability plots for the lead background and site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 50 it can be seen that the background data roughly follows the line and that the p value for the corresponding Shapiro Wilk test is 0.51. Therefore it is concluded that the lead background data is normally distributed. From Figure 51 it can be seen that the site data do not roughly follows the line and that the p value for the corresponding Shapiro Wilk test is 0.00. Therefore it is concluded that the lead site data is not normally distributed.

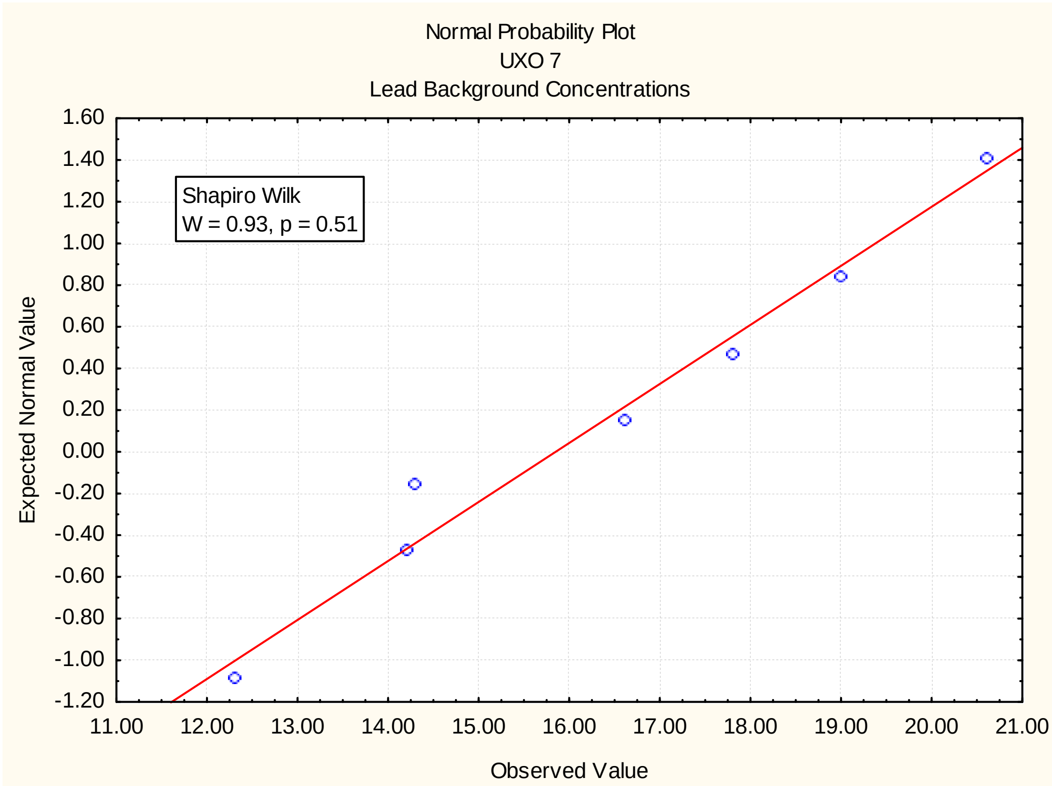


Figure 50

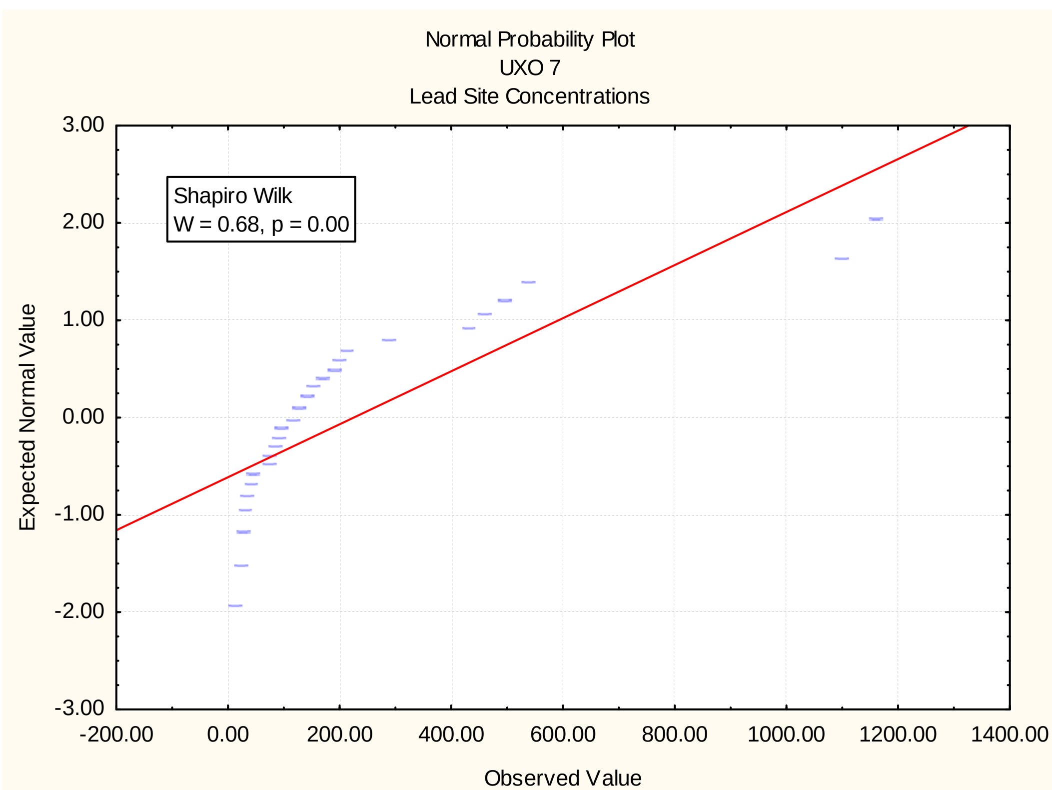


Figure 51

After examining the descriptive statistics, side by side box plots, means plots, and normality plot it can be concluded that the site lead concentrations are greater than the background lead concentrations.

Table 20 contains the descriptive statistics for magnesium for UXO 7. From this table it can be seen that the mean, median, maximum, and lower quartile and upper quartile site concentrations are greater than the background concentrations.

	Descriptive Statistics UXO 7							
Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Magnesium Site	29	2020.52	1680.00	723.00	7000.00	1140.00	2280.00	1416.02
Magnesium Background	8	1148.25	1160.00	876.00	1330.00	1020.00	1310.00	168.38

Table 20

Figure 52 contains the side by side box plots for magnesium for UXO 7. From these plots it can be seen that the lower quartile of the site magnesium concentrations is slightly lower than the upper quartile for the background concentrations.

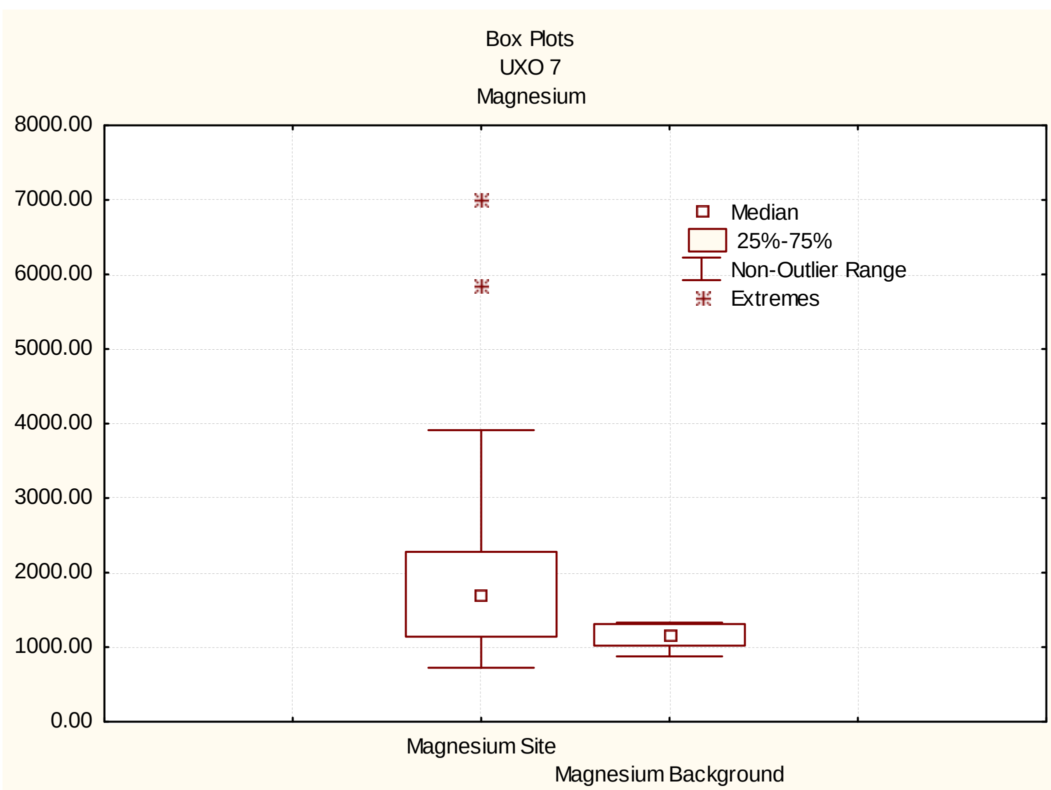


Figure 52

Figure 53 shows the side by side means plots. From this figure it can be seen that the site mean concentration is higher than the mean background concentration. The Upper Confidence limit of the background magnesium concentrations is less than the Lower

Confidence Limit for the site magnesium concentrations

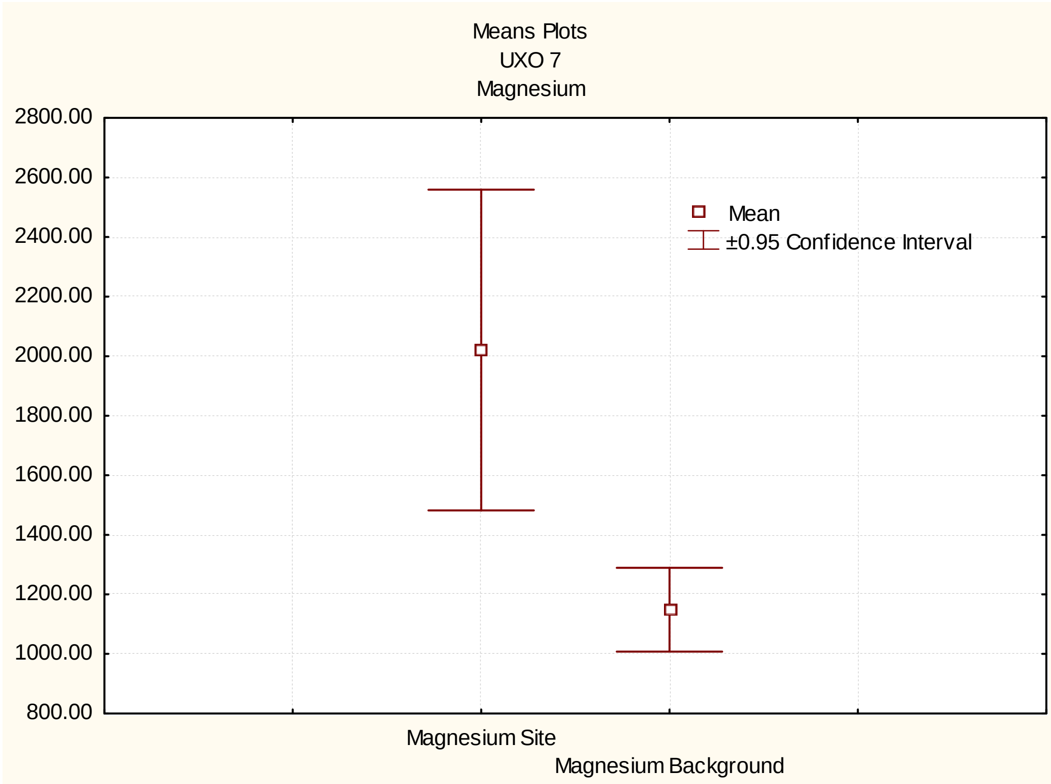


Figure 53

Figures 54 and 55 show the normal probability plots for the magnesium background and site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 54 it can be seen that the background data roughly follows the line and that the p value for the corresponding Shapiro Wilk test is 0.38. Therefore it is concluded that the magnesium background data is normally distributed. From Figure 55 it can be seen that the site data do not roughly follows the line and that the p value for the corresponding Shapiro Wilk test is 0.00. Therefore it is concluded that the magnesium site data is not normally distributed.

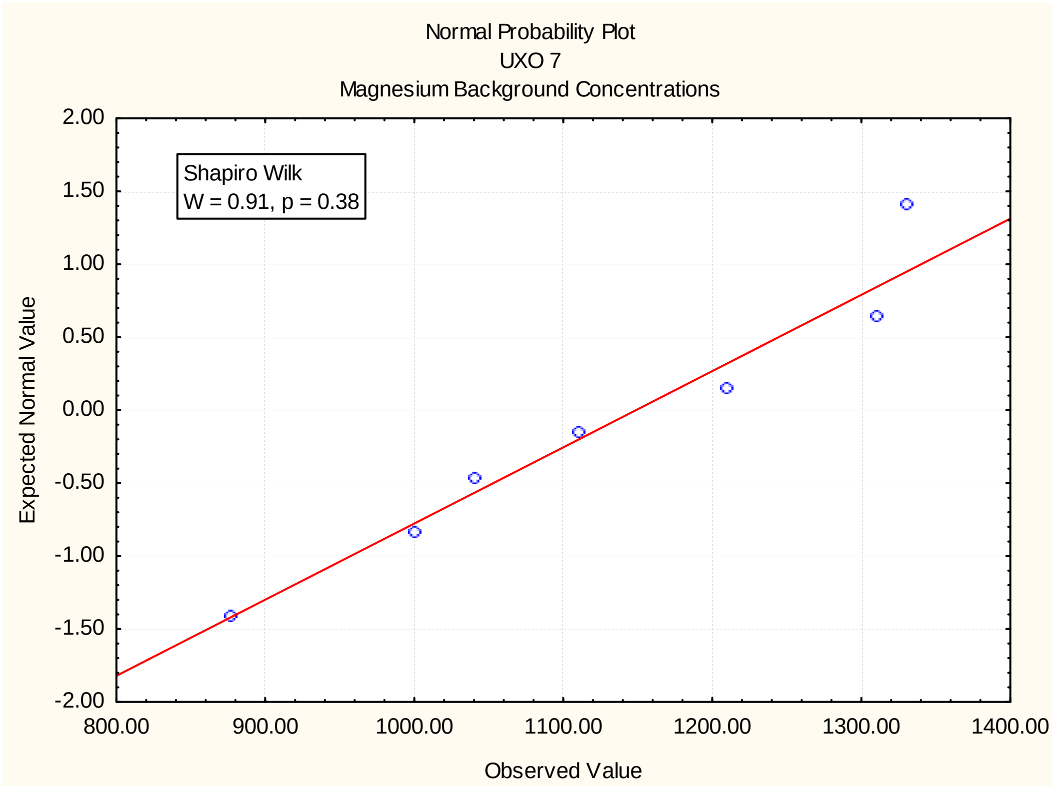


Figure 54

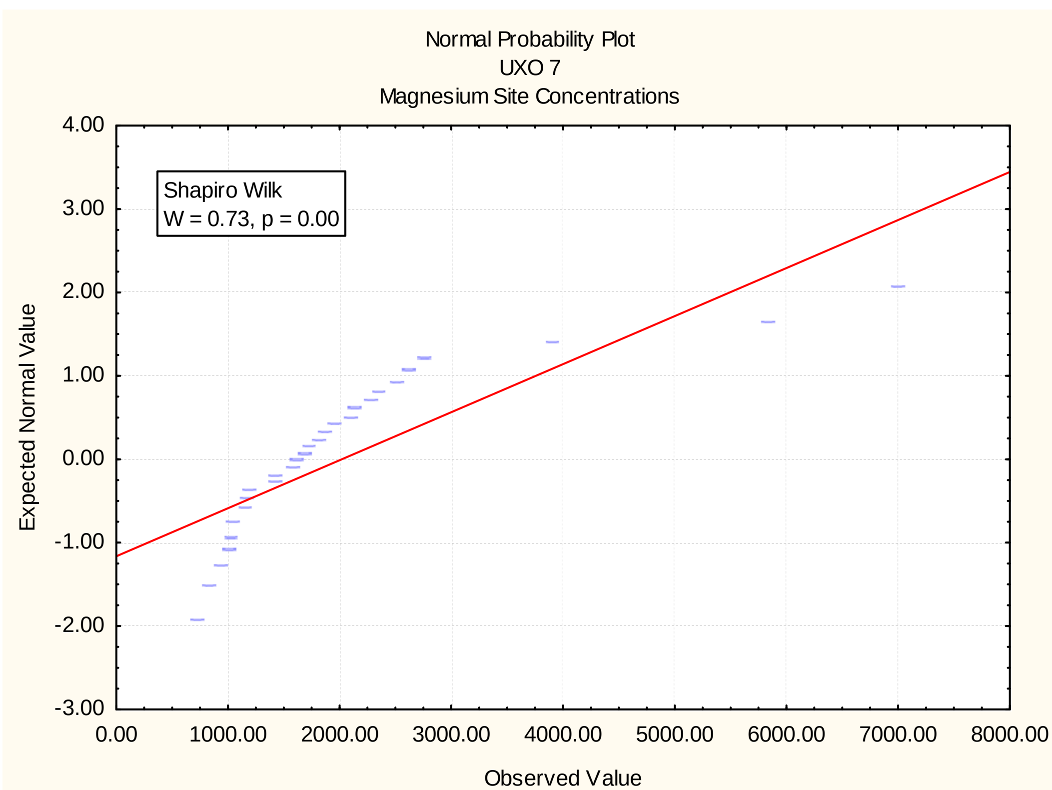


Figure 55

After examining the descriptive statistics, side by side box plots, means plots, and normality plot it can be concluded that the site magnesium concentrations are greater than the background magnesium concentrations.

Table 21 contains the descriptive statistics for manganese for UXO 7. From this table it can be seen that the mean, median, minimum, maximum, lower and upper quartile site concentrations are less than the background concentrations.

	Descriptive Statistics UXO 7							
Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Manganese Site	29	811.55	749.00	334.00	1370.00	637.00	974.00	291.04
Manganese Background	8	1417.25	1405.00	666.00	3040.00	786.00	1625.00	765.27

Table 21

Figure 56 contains the side by side box plots for manganese for UXO 7. From these plots it can be seen that the site manganese upper quartile is slightly higher than the background lower quartile. The upper whisker for the manganese site concentrations is approximately at the same concentration as the median manganese background concentration.

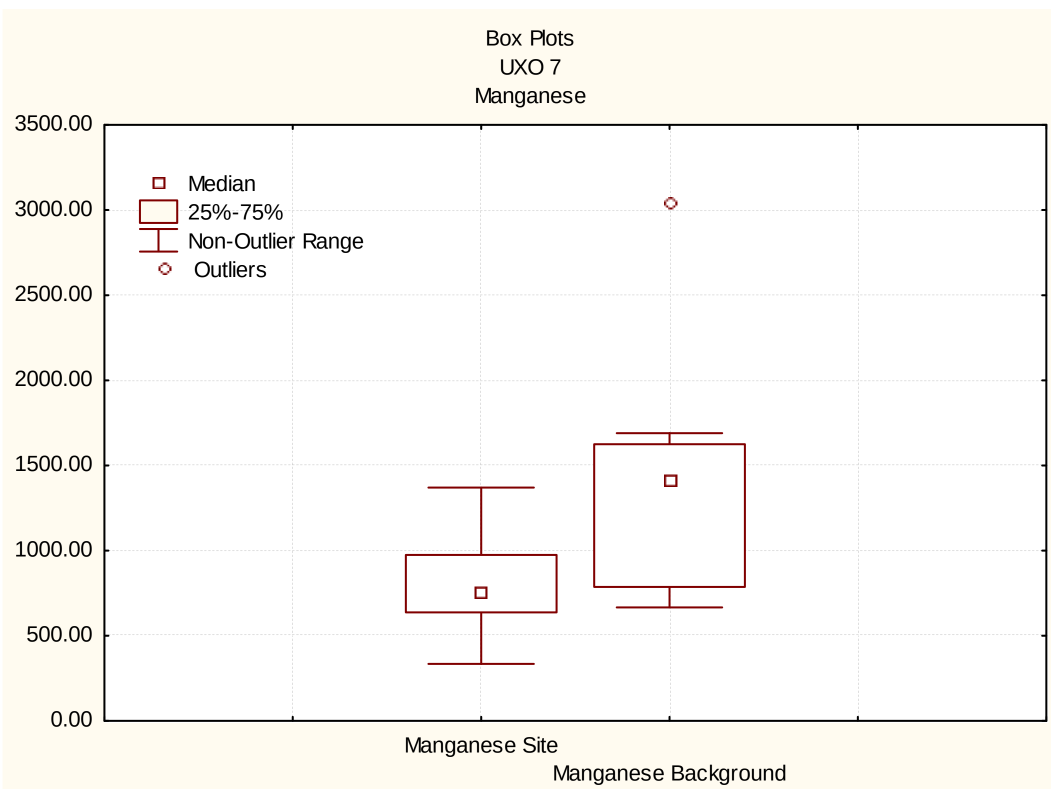


Figure 56

Figure 57 contains the side by side means plots for manganese for UXO 7. From this plot it can be seen that the mean concentration for the site manganese concentrations is slightly higher than the lower confidence limit of the background concentration. It can also be seen that the mean site manganese concentration is at roughly the same concentration as the lower confidence limit of the background manganese concentration.

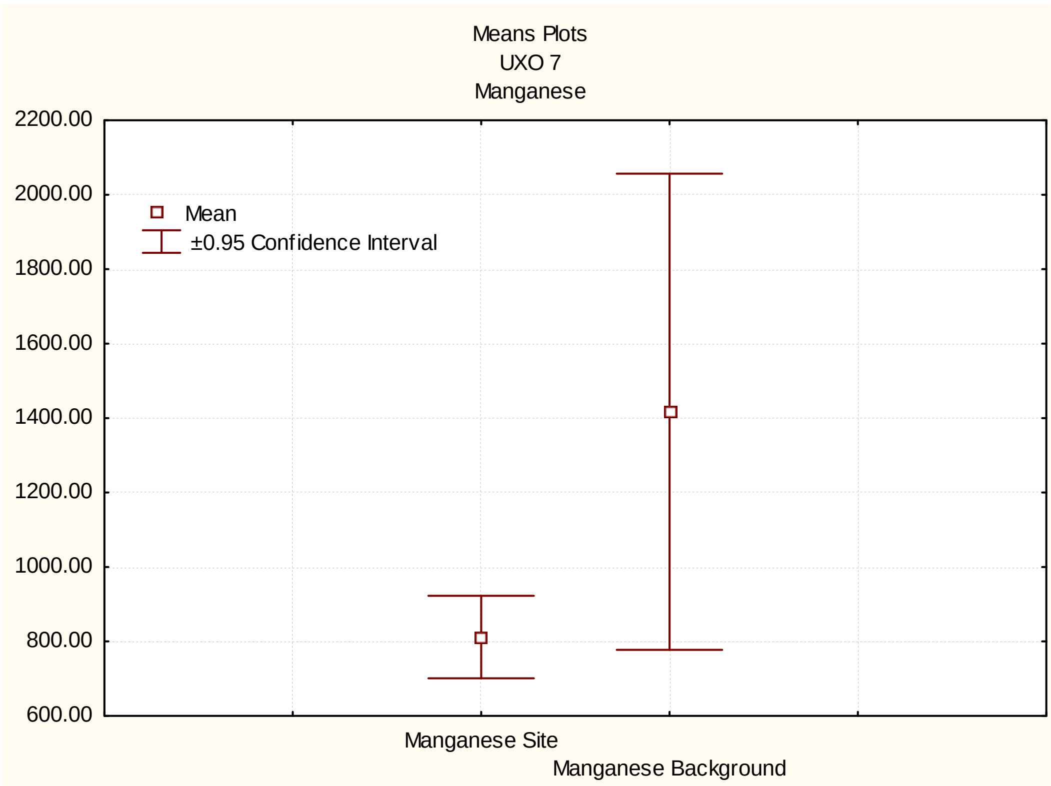


Figure 57

Figures 58 and 59 show the normal probability plots for the manganese background and site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 58 it can be seen that the background data does not roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.10. Therefore it is concluded that the manganese background data is not normally distributed. From Figure 59 it can be seen that the site data does not roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.00. Therefore it is concluded that the calcium site data is not normally distributed.

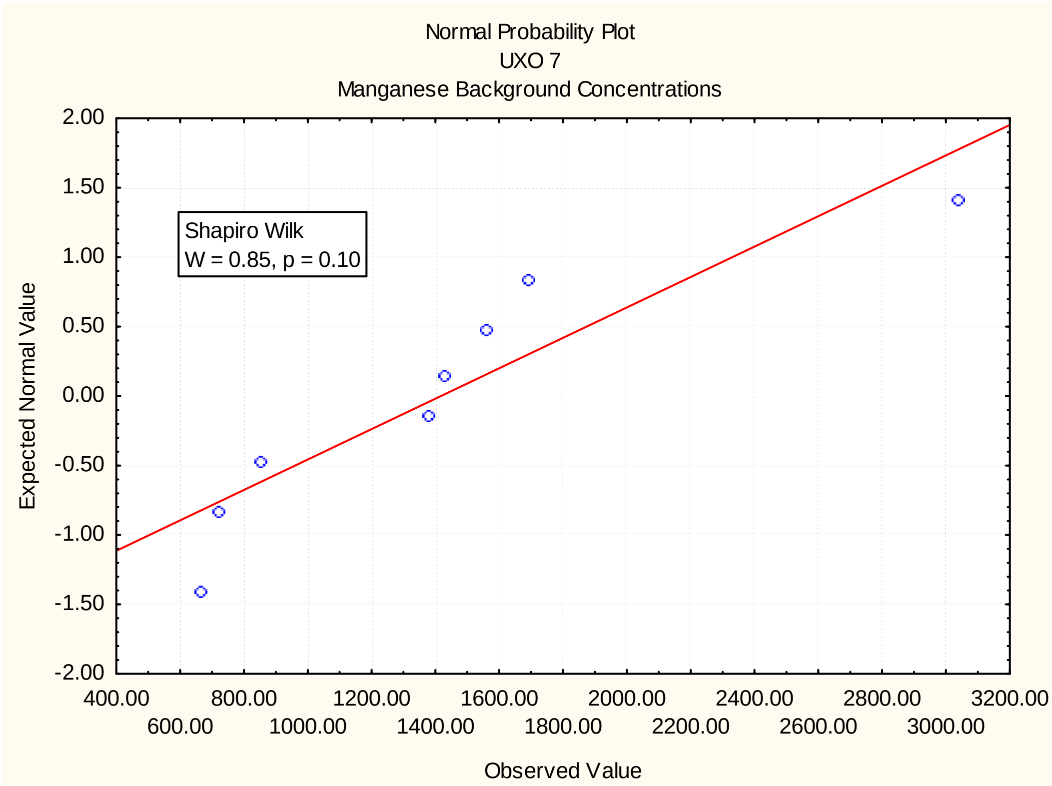


Figure 58

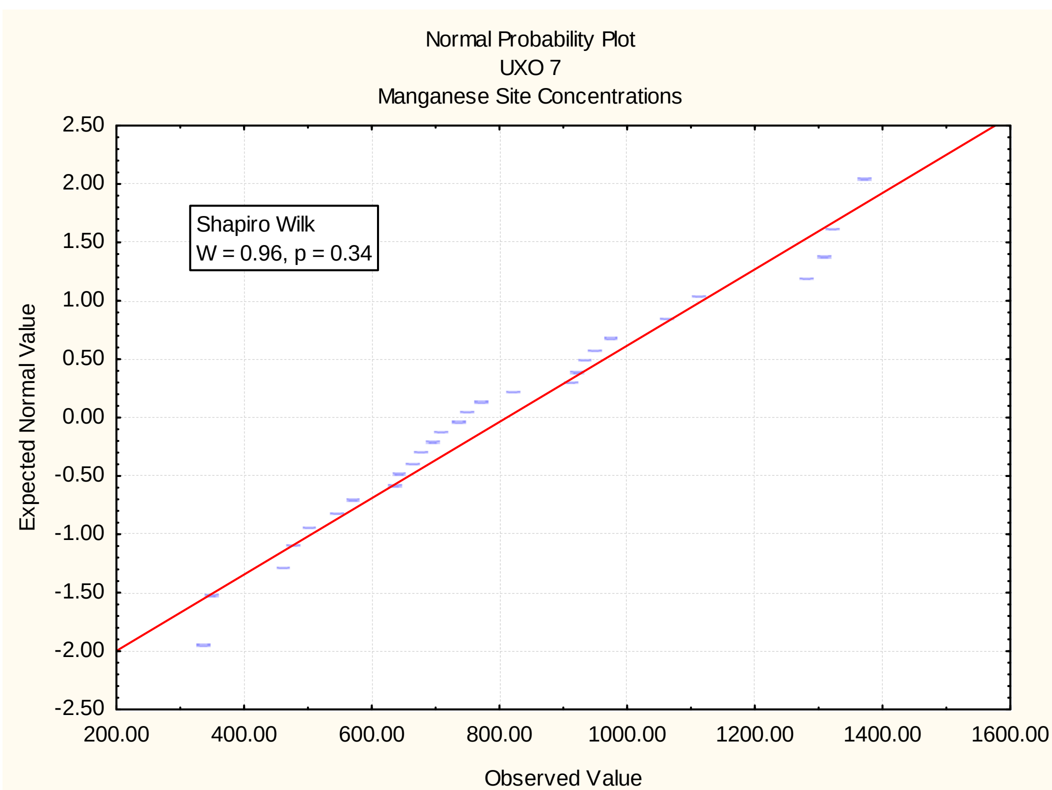


Figure 59

After examining the descriptive statistics, side by side box plots, means plots, and normality plot it can be concluded that the site manganese concentrations are greater than the background manganese concentrations.

Table 22 contains the descriptive statistics for nickel for UXO 7. From this table it can be seen that the mean, median, maximum, lower quartile and upper quartile site concentrations are greater than the background concentrations.

Variable	Descriptive Statistics UXO 7							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Nickel Site	29	21.17	19.10	8.75	50.20	15.70	25.90	8.22
Nickel Background	8	12.23	13.00	8.80	14.20	10.70	13.70	1.94

Table 22

Figure 60 contain the side by side box plots for nickel for UXO 7. From this plots it can be seen that the site nickel distribution is higher than the background nickel distribution. The Lower Quartile for the site data is higher than the Upper Quartile of the background data.

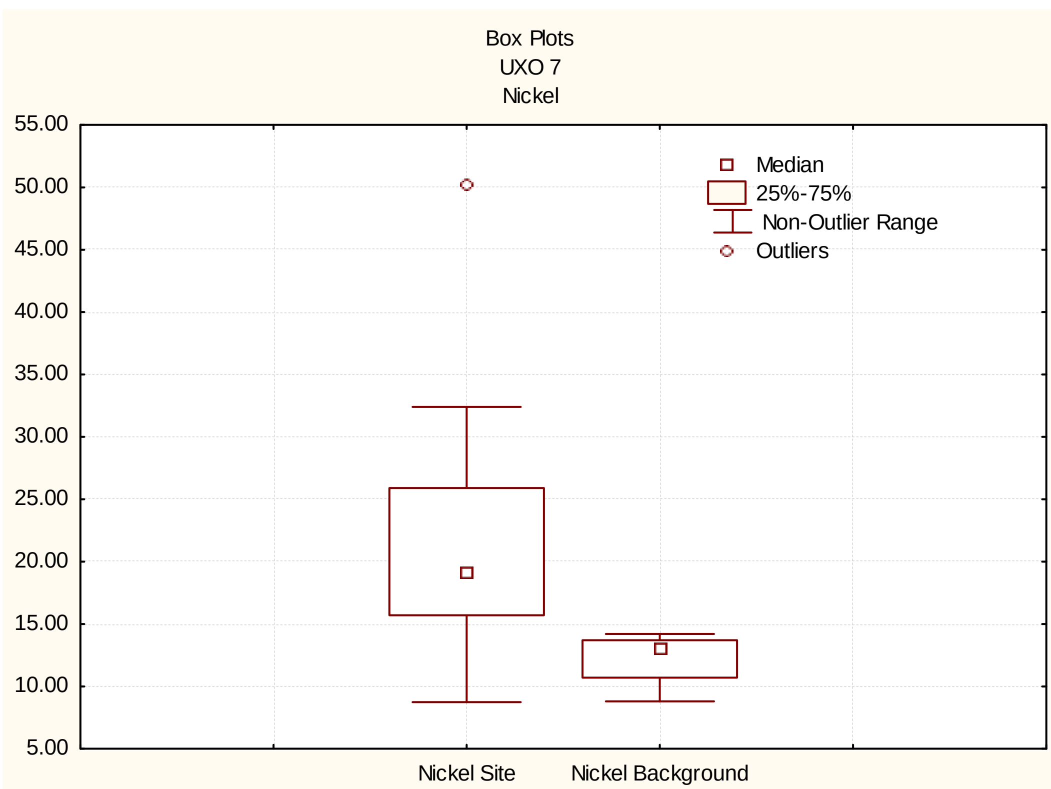


Figure 60

Figure 61 contains the side by side means plots for nickel for UXO 7. From this plot it can be seen that the lower confidence limit is higher than the upper confidence limit for the background nickel concentrations.

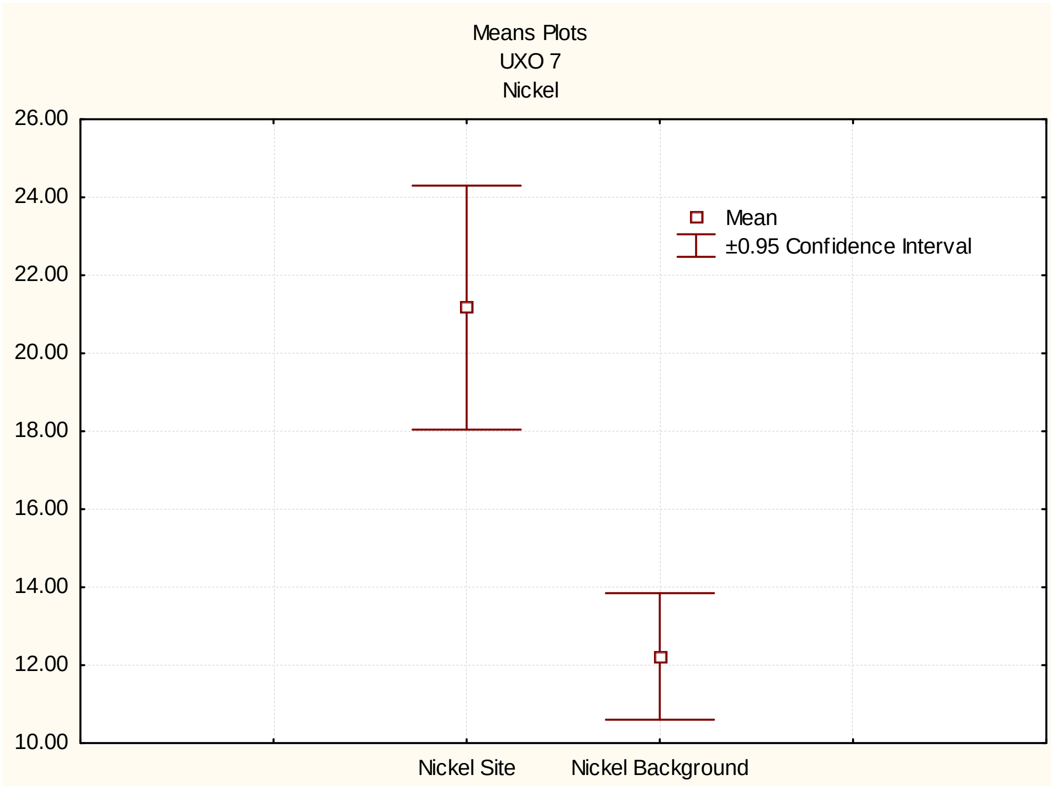


Figure 61

Figures 62 and 63 show the normal probability plots for the nickel background and site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 62 it can be seen that the background data roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.23. Therefore it is concluded that the nickel background data is normally distributed. From Figure 63 it can be seen that the site data does not roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.00. Therefore it is concluded that the nickel site data is not normally distributed.

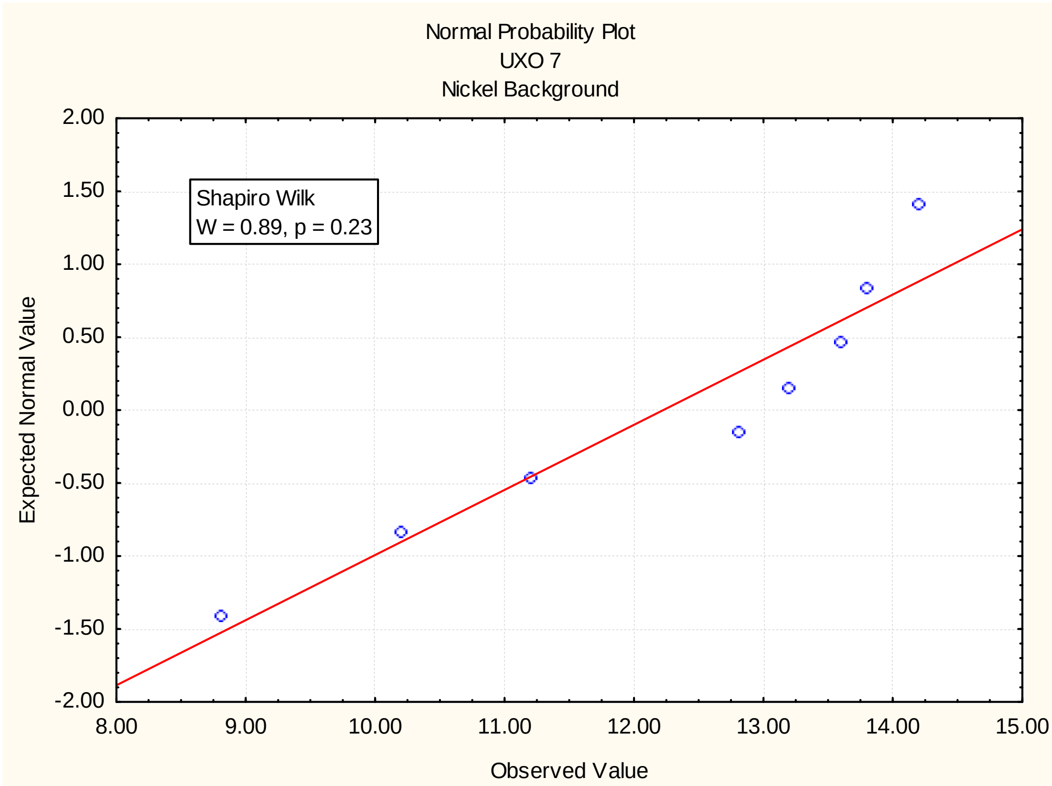


Figure 62

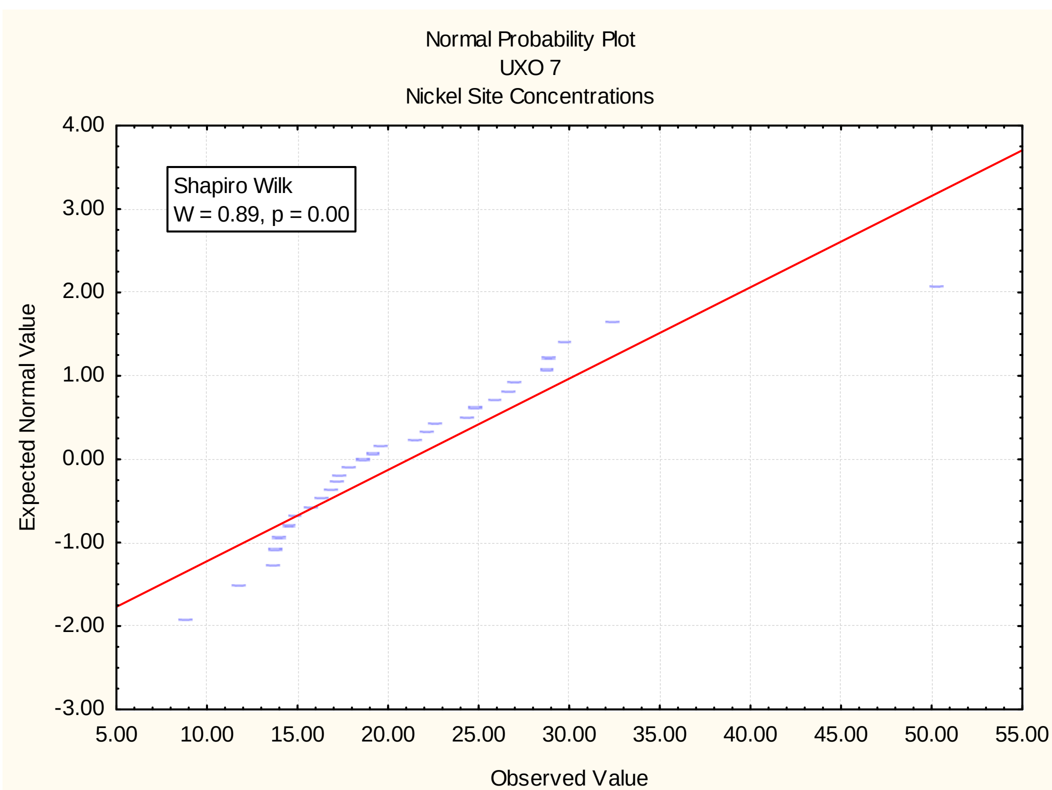


Figure 63

After examining the descriptive statistics, side by side box plots, means plots, and normality plot it can be concluded that the site nickel concentrations are greater than the background nickel concentrations.

Table 23 contains the descriptive statistics for potassium for UXO 7. From this table it can be seen that the mean, median, maximum, lower quartile and upper quartile site concentrations are greater than the background concentrations.

Variable	Descriptive Statistics UXO 7							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Potassium Site	29	1084.66	884.00	476.00	2380.00	768.00	1210.00	473.92
Potassium Background	8	839.38	796.00	584.00	1340.00	659.00	940.50	249.40

Table 23

Figure 64 contains the side by side box plots for potassium for UXO 7. From this table it can be seen that the median site concentration is slightly higher than the background concentration. From this plot it can be seen that the distribution of the two data sets are similar with the site concentrations shifted slightly higher than the background concentrations.

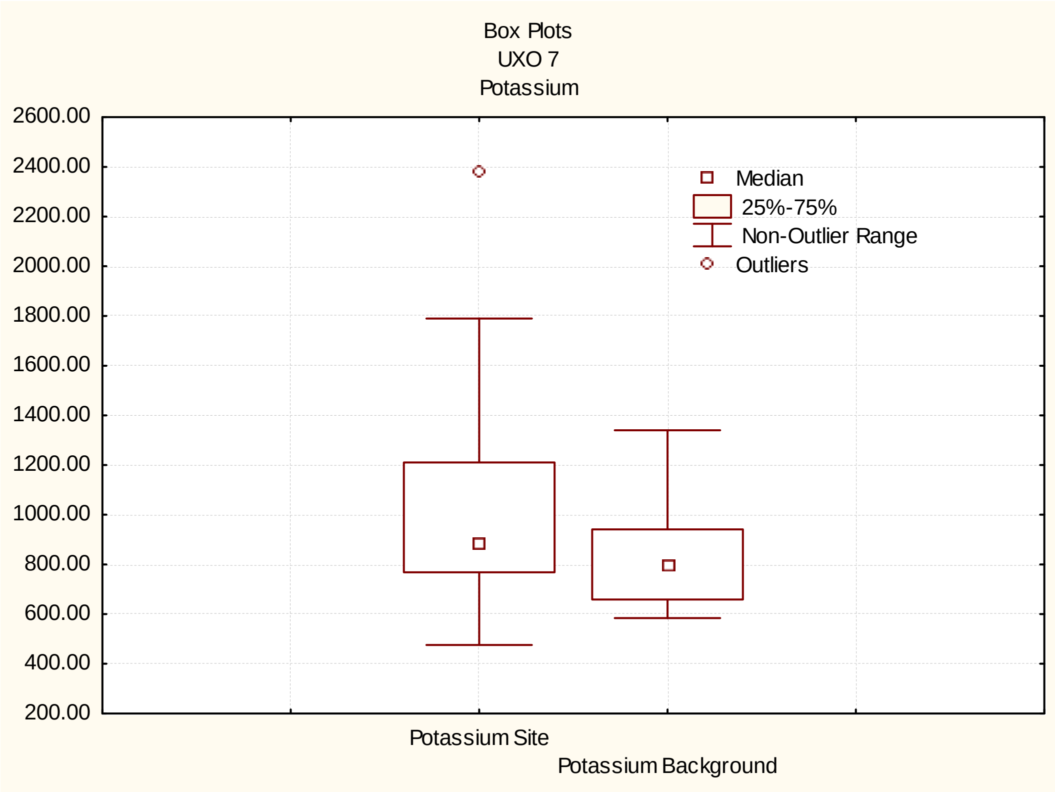


Figure 64

Figure 65 shows the side by side means plots for potassium for UXO 7. From this figure it can be seen that the mean site potassium concentration is higher than the background mean concentration. The site mean concentration for potassium is at roughly the same concentration as the upper confidence limit for the background concentration.

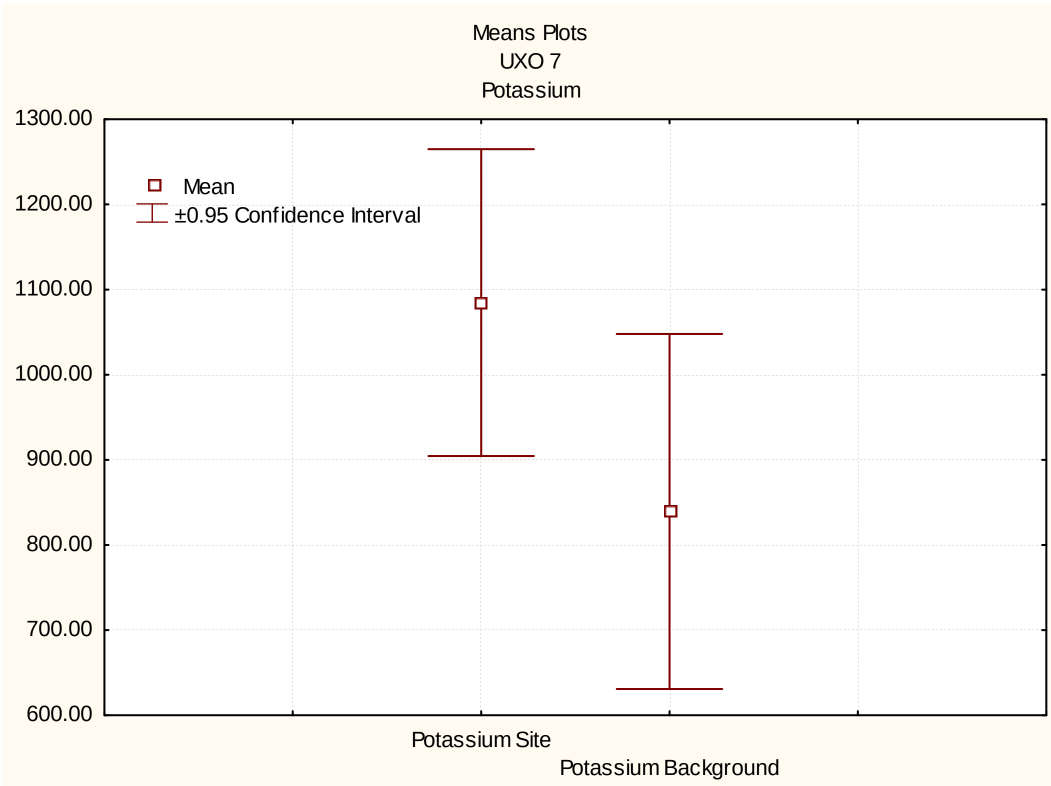


Figure 65

Figure 66 and 67 show the normal probability plots for the potassium background and site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 66 it can be seen that the background data roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.17. Therefore it is concluded that the potassium background data is not normally distributed. From Figure 67 it can be seen that the site data do not roughly follows the line and that the p value for the corresponding Shapiro Wilk test is 0.00. Therefore it is concluded that the potassium site data is not normally distributed.

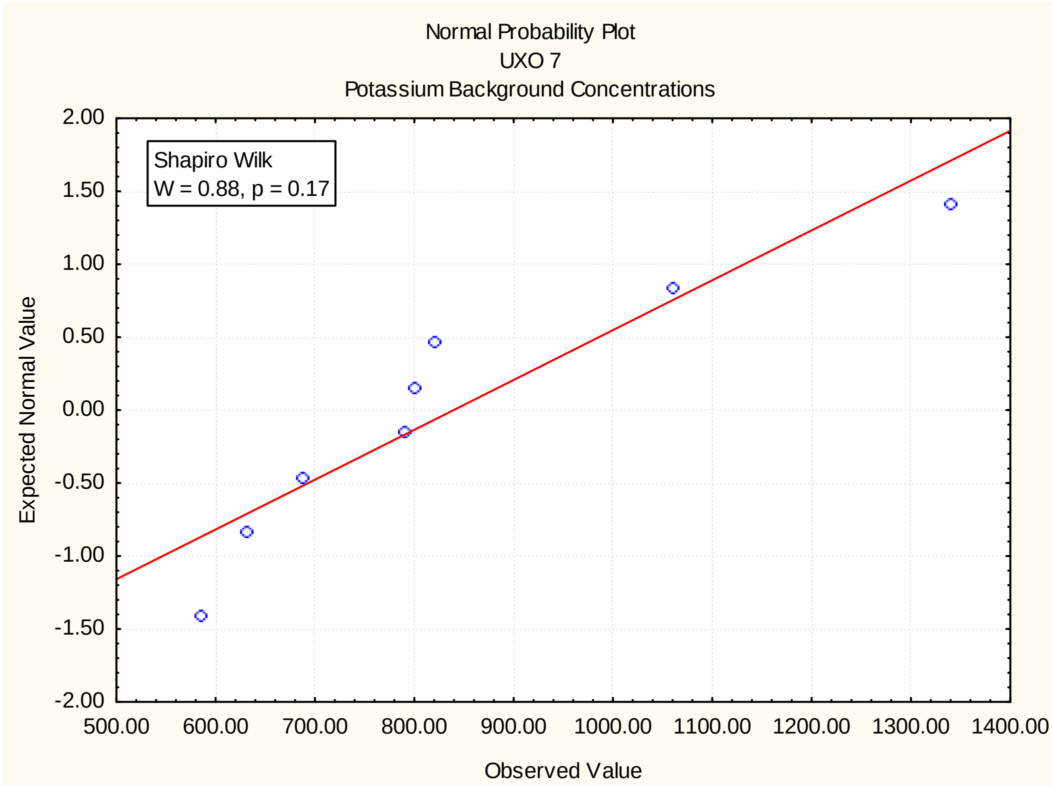


Figure 66

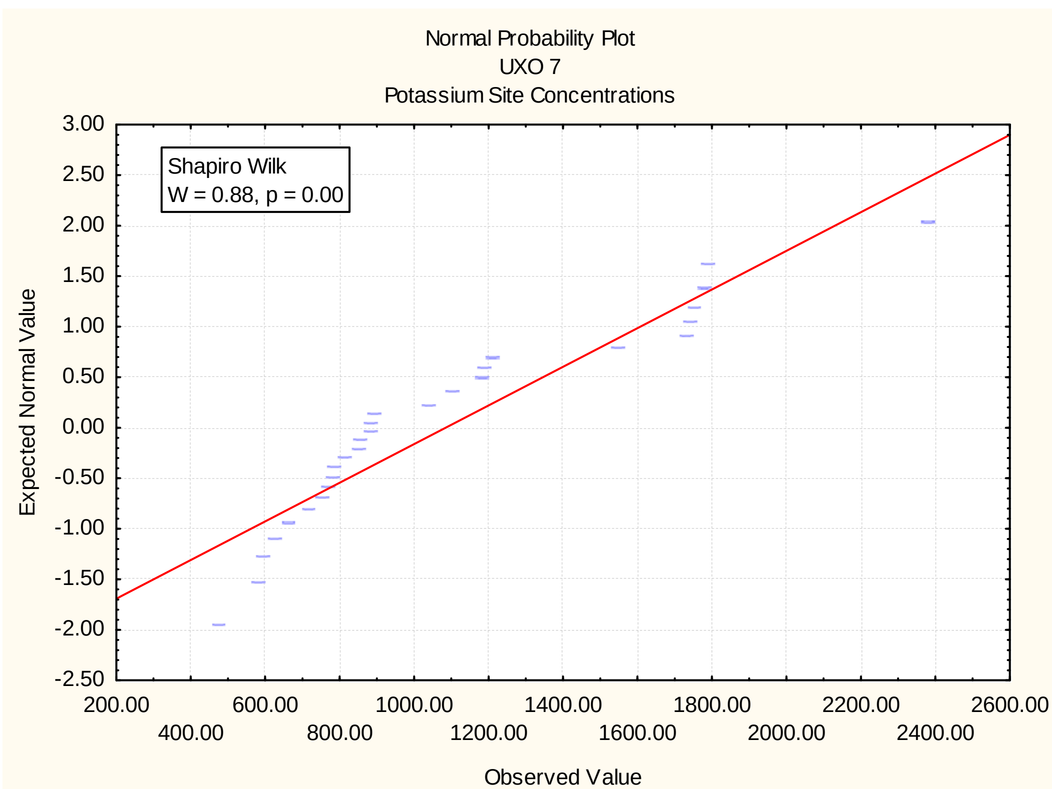


Figure 67

Table 24 contains the Test Statistic and corresponding p value for Levene's test for equality of variance. The Levene Test tests the hypothesis that the variances of the Site and Background Concentrations are equal. If the p-value for Levene's test is less than 0.05 than the variances of the distributions are not equal. From Table 24 it can be seen that the p-value for Levene's Test is 0.06 so the variances of the Site and Background Poitassium Concentrations are equal.

Levene's Test	
Levene F(1,df)	3.71
Degrees of freedom (df)	35
p-value	0.06

Table 24

Because the site and background concentrations are not normally distributed and the variances are equal, the Wilcoxon Rank Sum Test was used to determine if there are differences between the two data sets. The Wilcoxon Rank Sum Test tests the hypothesis that the site potassium concentrations are equal to the background potassium concentrations. Table 25 contains the Test Statistic and corresponding p value for the Wilcoxon Rank Sum Test, because the pvalue is greater than 0.05 we fail to reject the null that there is no difference between the background and site concentrations.

Wilcoxon Rank Sum Test	
Test Statistic	1.29
P Value	0.0985

Table 25

Table 26 contains the descriptive statistics for selenium for UXO 7. From this table it can be seen that the mean, median, minimum, maximum, lower quartile and upper quartile site concentrations are slightly higher than the background concentrations.

Variable	Descriptive Statistics UXO 7							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Selenium Site	29	0.51	0.55	0.25	0.91	0.37	0.63	0.17
Selenium Background	8	0.46	0.48	0.32	0.65	0.36	0.50	0.11

Table 26

Figure 68 contains the side by side box plots for selenium for UXO 7. From this figure it can be seen that the median site concentration is higher than the background median concentration. It can also be seen that the median concentration is at roughly the same concentration as the upper whisker for the background concentrations.

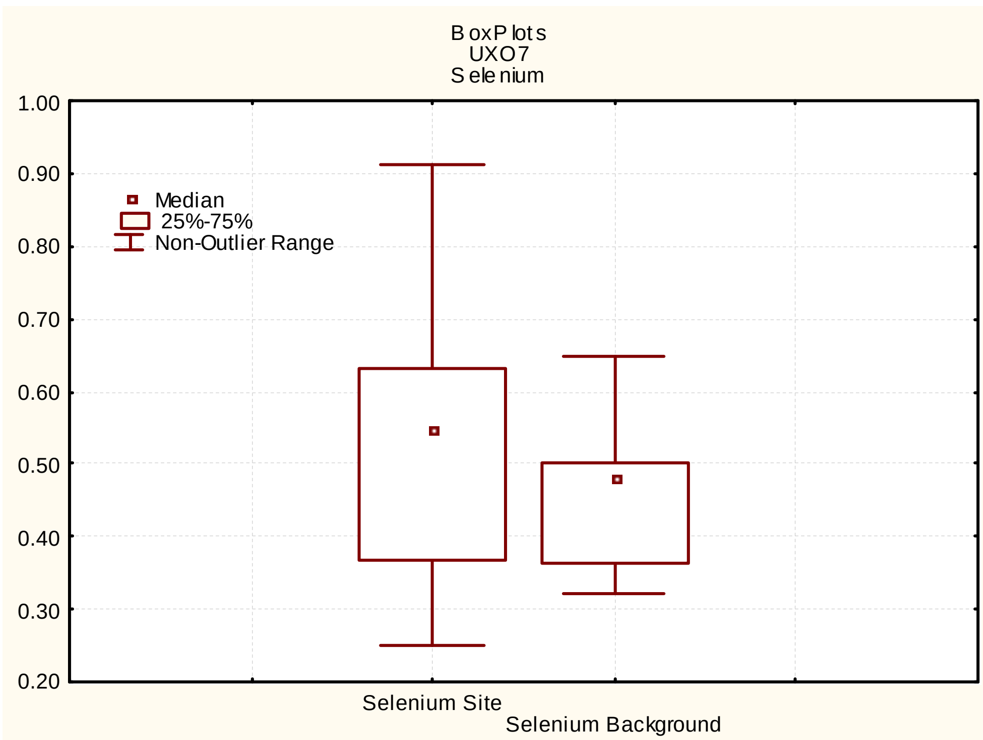


Figure 68

Figure 69 contains the side by side mean plot for the selenium site and background concentrations. From figure 69 it can be seen that the site selenium concentration is higher than the background mean concentration. The upper whisker for the site concentration is slightly higher than the upper whisker for the background concentration.

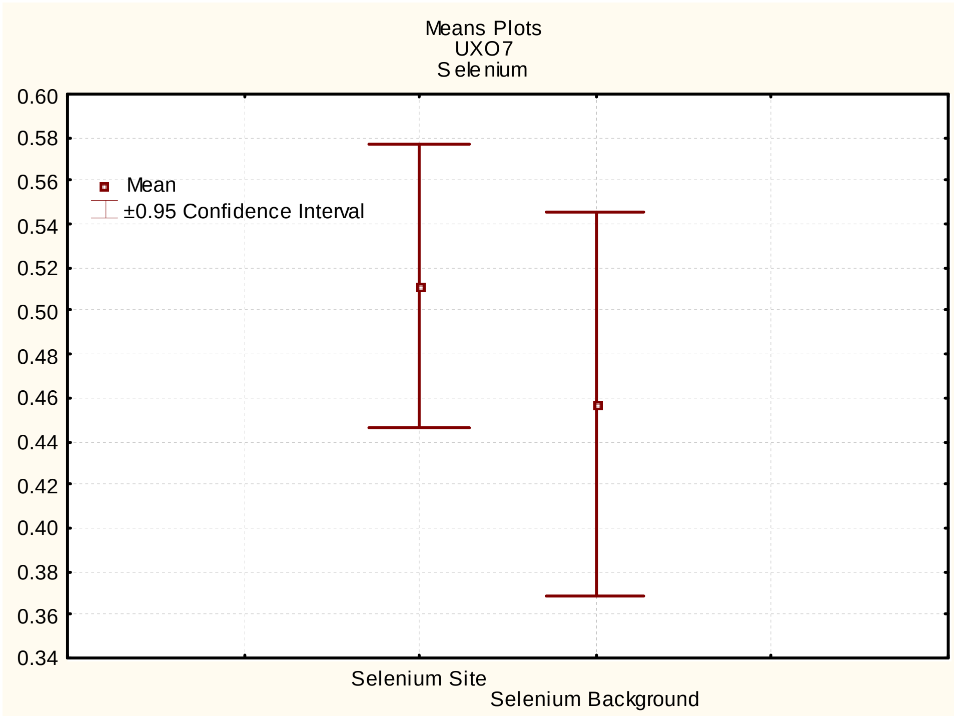


Figure 69

Figure 70 and 71 show the normal probability plots for the selenium background and site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 70 it can be seen that the background do not roughly follow the line (step pattern) and that the p value for the corresponding Shapiro Wilk test is 0.40. Therefore it is concluded that the selenium background data is not normally distributed. From Figure 71 it can be seen that the site data roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.26. Therefore it is concluded that the selenium site data is normally distributed.

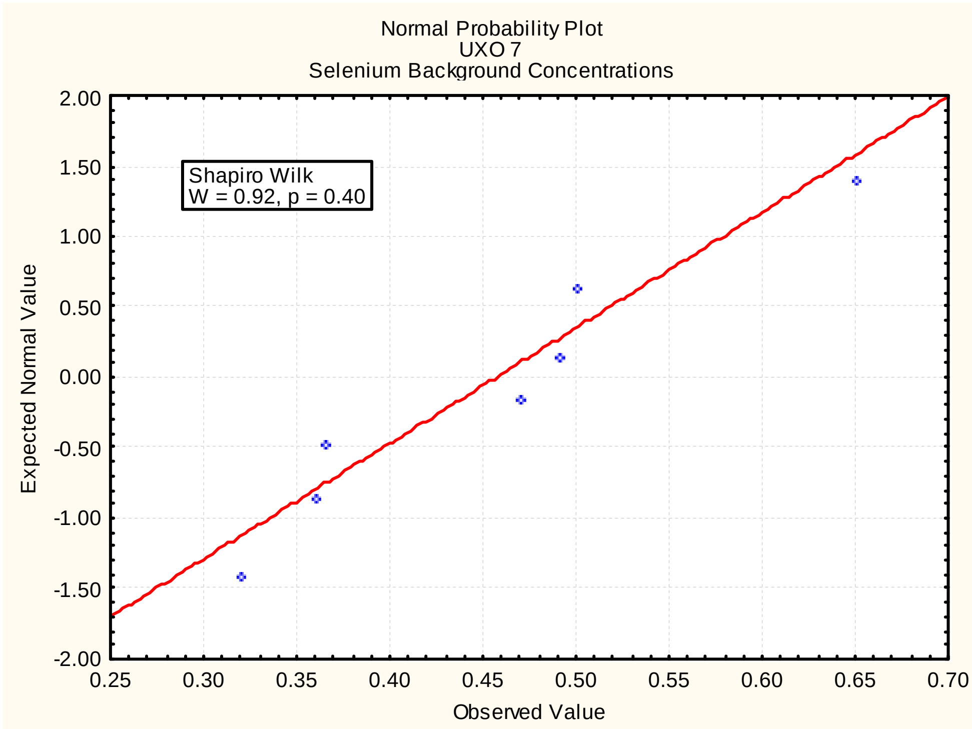


Figure 70

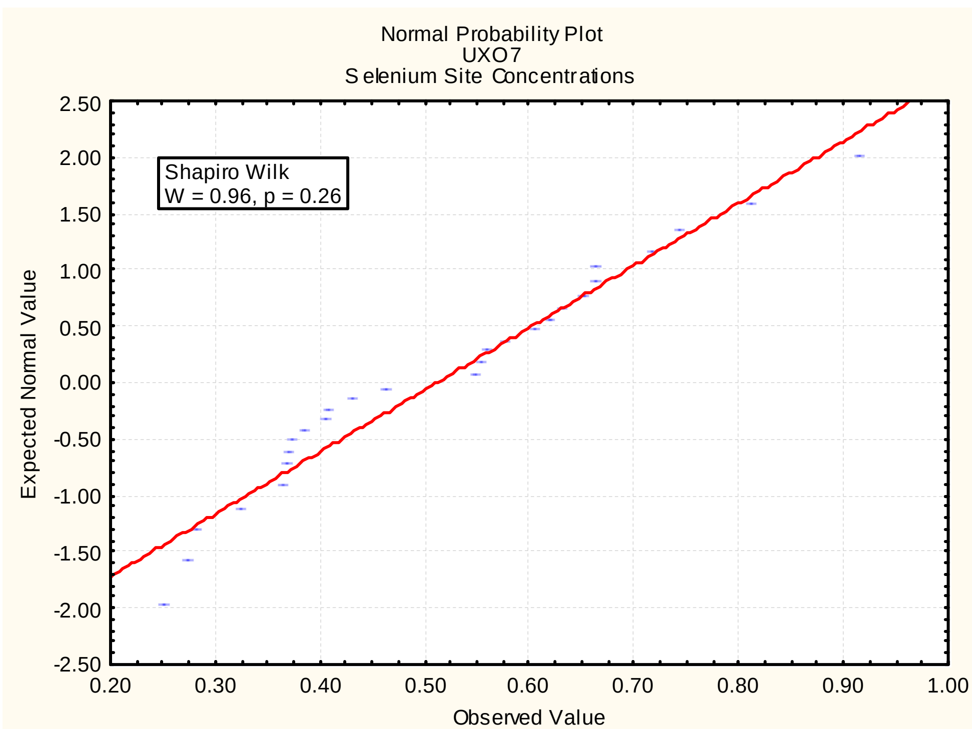


Figure 71

Table 27 contains the Test Statistic and corresponding p value for Levene's test for equality of variance. The Levene Test tests the hypothesis that the variances of the Site and Background Concentrations are equal. If the p-value for Levene's test is less than 0.05 than the variances of the distributions are not equal. From Table 27 it can be seen that the p-value for Levene's Test is 0.06 so the variances of the Site and Background selenium Concentrations are equal.

Levene's Test	
Levene F(1,df)	3.96
Degrees of freedom (df)	35
p-value	0.06

Table 27

Because the site and background concentrations are not normally distributed and the variances are equal, the Wilcoxon Rank Sum Test was used to determine if there are differences between the two data sets. The Wilcoxon Rank Sum Test tests the hypothesis that the site selenium concentrations are equal to the background selenium concentrations. Table 28 contains the Test Statistic and corresponding p value for the Wilcoxon Rank Sum Test, because the pvalue is greater than 0.05 we fail to reject the null that there is no difference between the background and site concentrations.

Wilcoxon Rank Sum Test	
Test Statistic	0.93
P Value	0.18

Table 28

Table 29 contains the descriptive statistics for silver for UXO 7. From this table it can be seen that the mean, median, minimum, maximum, lower quartile and upper quartile site silver concentrations are slightly higher than the background concentrations.

	Descriptive Statistics UXO 7							
Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Silver Site	29	0.12	0.11	0.06	0.24	0.10	0.14	0.04
Silver Background	8	0.06	0.06	0.05	0.06	0.06	0.06	0.00

Table 29

Figure 73 contains the side by side box plots for silver. From this figure it can be seen that the Silver site distribution is higher than the background concentrations. The lower whisker for the site data is at roughly the same concentration as the 75th percentile.

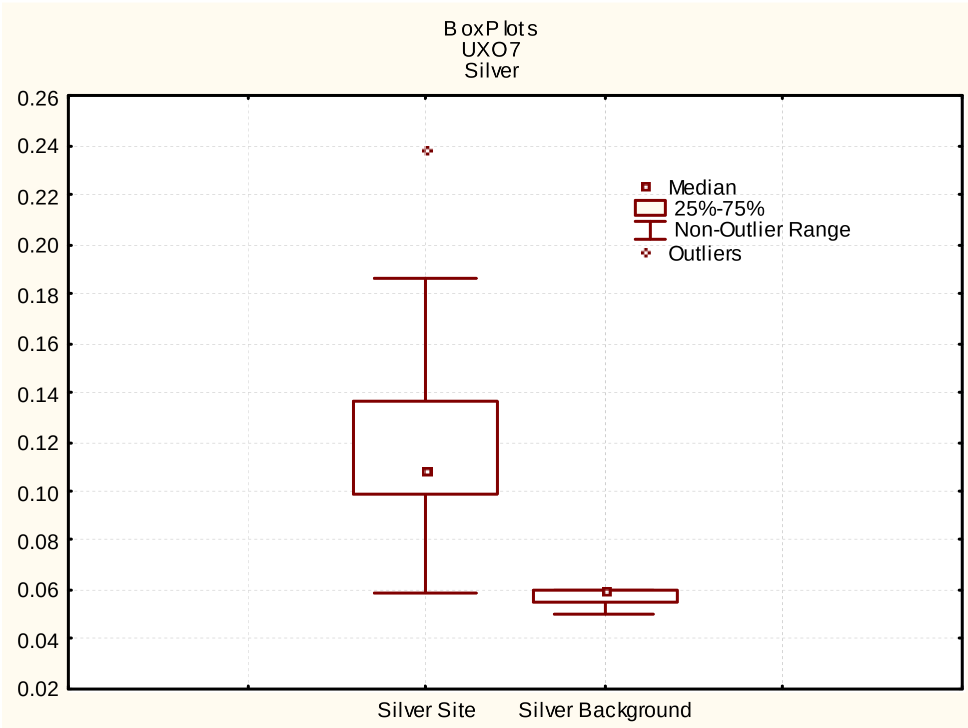


Figure 73

Figure 74 contains the side by side means plot for silver. From this plot it can be seen that the lower confidence limit for the site concentration is higher than the upper confidence limit for the background concentration.

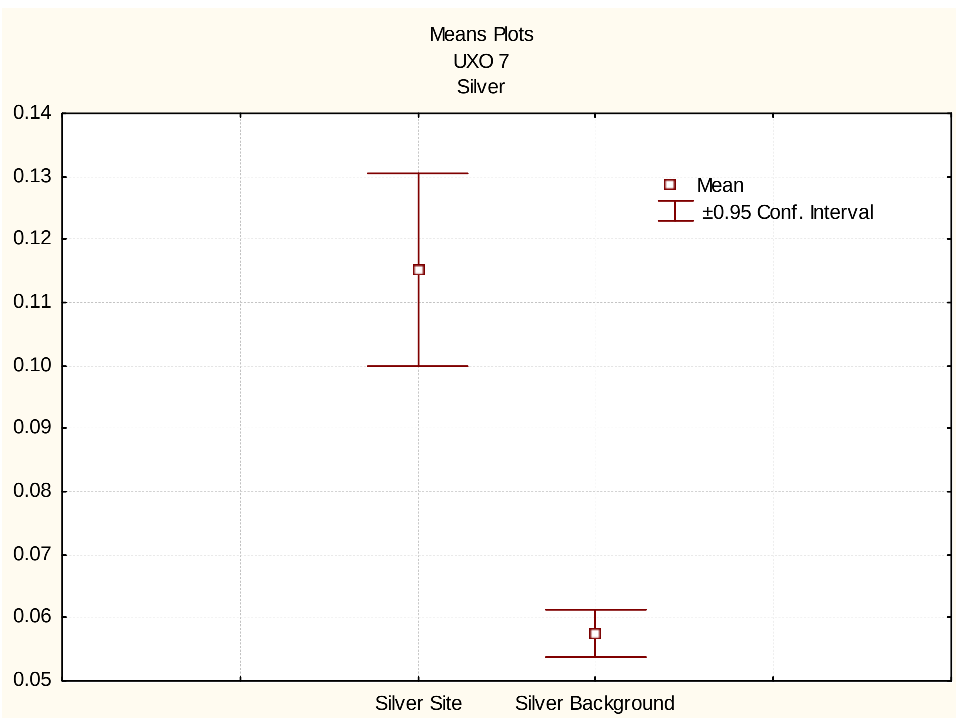


Figure 74

Figure 75 show the normal probability plot for the silver site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 75 it can be seen that the site data do not roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.05. Therefore it is concluded that the silver site data is not normally distributed.

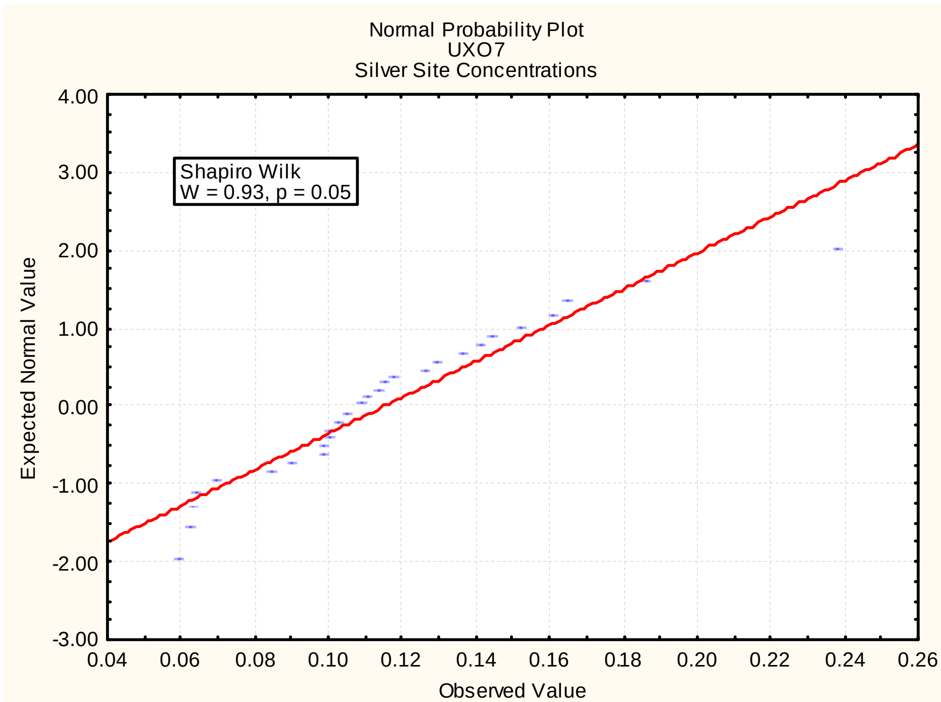


Figure 75

After examining the descriptive statistics, side by side box plots, means plots, and normality plot it can be concluded that the site silver concentrations are greater than the background silver concentrations.

Table 30 contains the descriptive statistics for thallium for UXO7. From this table it can be seen that the mean and maximum site concentrations are slightly higher than the background concentrations. The median site and background concentrations are equal; the minimum and lower and upper quartile background concentrations are higher than the site concentrations.

Variable	Descriptive Statistics UXO 7							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Thallium Site	29	0.20	0.18	0.06	0.53	0.16	0.21	0.09
Thallium Background	8	0.19	0.18	0.15	0.22	0.17	0.22	0.03

Table 30

Figure 76 contains the side by side box plots. From this plot it can seen that the distributions of the two data sets are extremely close.

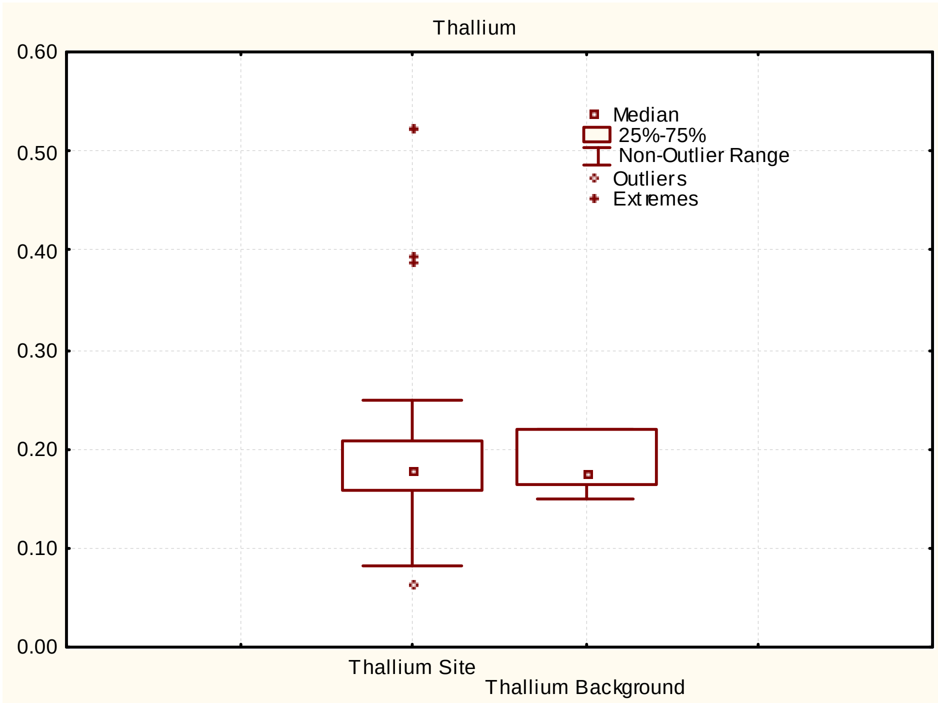


Figure 76

Figure 77 contains the side by side means plots. From this plot it can be seen that site mean concentration is slightly higher than the mean background concentration.

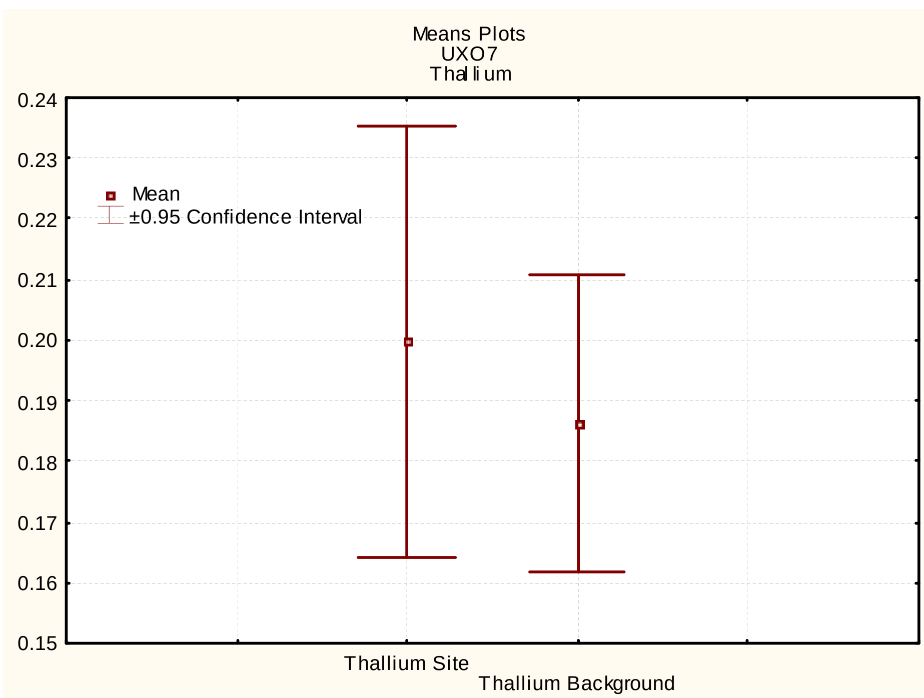


Figure 77

Figure 78 and 79 show the normal probability plots for the thallium background and site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 78 it can be seen that the background data do not roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.06. Therefore it is concluded that the thallium background data is not normally distributed. From Figure 79 it can be seen that the site data do not roughly follows the line and that the p value for the corresponding Shapiro Wilk test is 0.00. Therefore it is concluded that the thallium site data is not normally distributed.

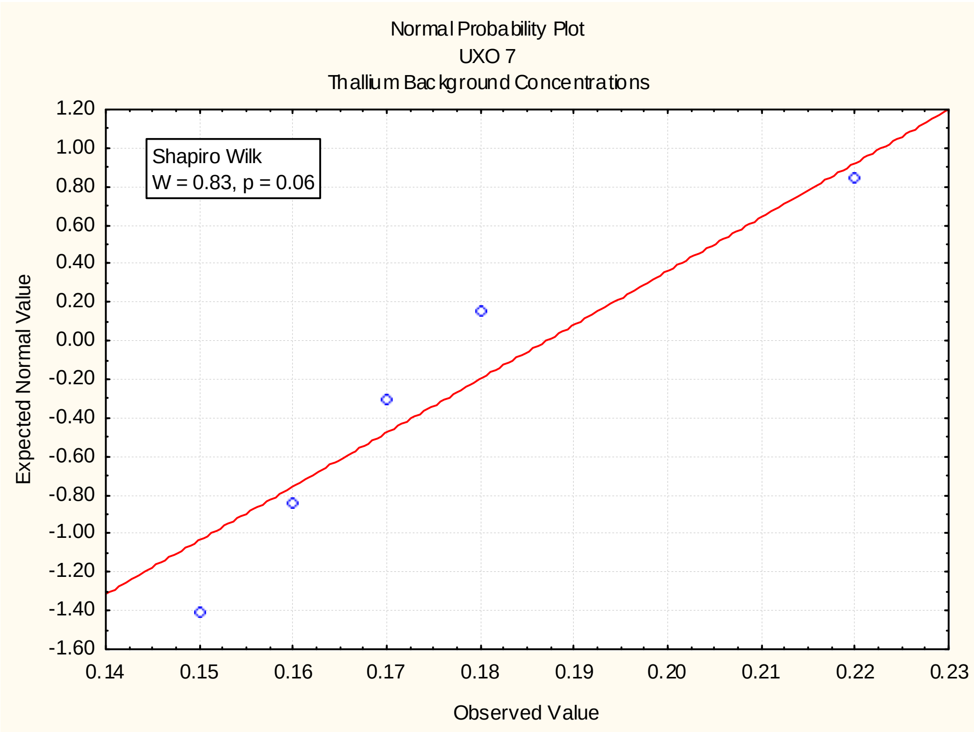


Figure 78

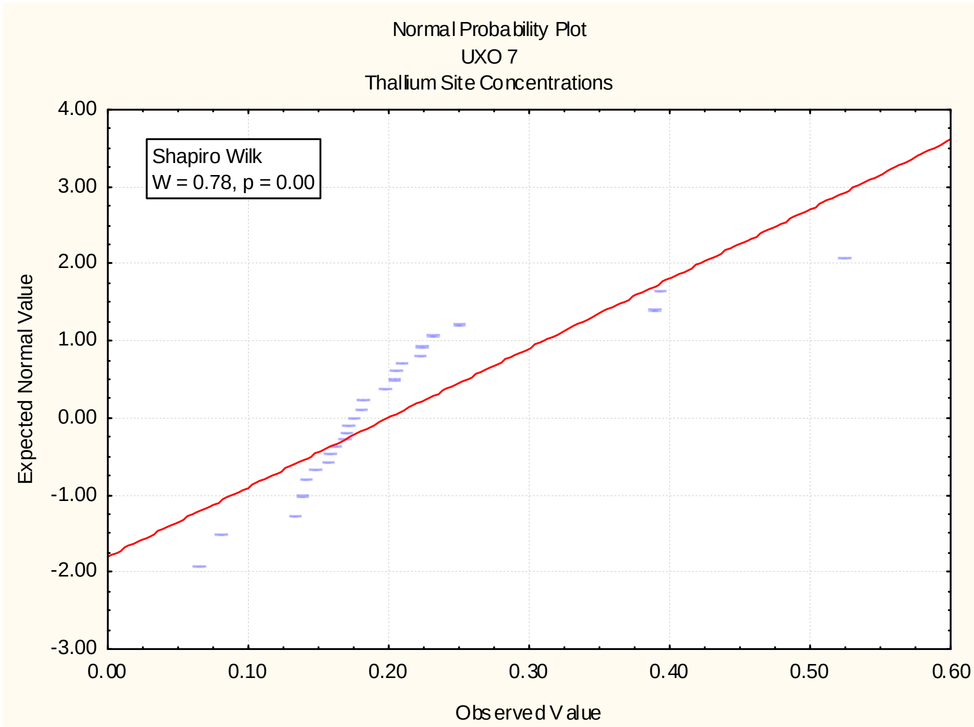


Figure 79

Table 31 contains the Test Statistic and corresponding p value for Levene's test for equality of variance. The Levene Test tests the hypothesis that the variances of the Site and Background Concentrations are equal. If the p-value for Levene's test is less than 0.05 than the variances of the distributions are not equal. From Table 31 it can be seen that the p-value for Levene's Test is 0.20 so the variances of the Site and Background thallium Concentrations are equal.

Levene's Test	
Levene F(1,df)	1.74
Degrees of freedom (df)	35
p-value	0.20

Table 31

Because the site and background concentrations are not normally distributed and the variances are equal, the Wilcoxon Rank Sum Test was used to determine if there are differences between the two data sets. The Wilcoxon Rank Sum Test tests the hypothesis that the site thallium concentrations are equal to the background thallium concentrations. Table 32 contains the Test Statistic and corresponding p value for the Wilcoxon Rank Sum Test, because the pvalue is greater than 0.05 we fail to reject the null that there is no difference between the background and site concentrations.

Wilcoxon Rank Sum Test	
Test Statistic	-0.18
P Value	0.06

Table 32

Table 33 contains the descriptive statistics for vanadium for UXO 7. From this table it can be seen that the mean, median, minimum, maximum, lower and upper quartile site concentrations are greater than the background concentrations.

Variable	Descriptive Statistics UXO 7							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Vanadium Site	29	39.80	34.90	19.90	85.90	31.00	39.80	16.42
Vanadium Background	8	23.89	22.70	16.90	37.40	20.50	25.20	6.20

Table 33

Figure 80 contains the side by side box plots for vanadium for UXO 7. From this figure it can be seen that the site vanadium concentrations are higher than the background vanadium concentrations. The lower quartile for the site concentration is higher than the upper quartile for the background concentrations.

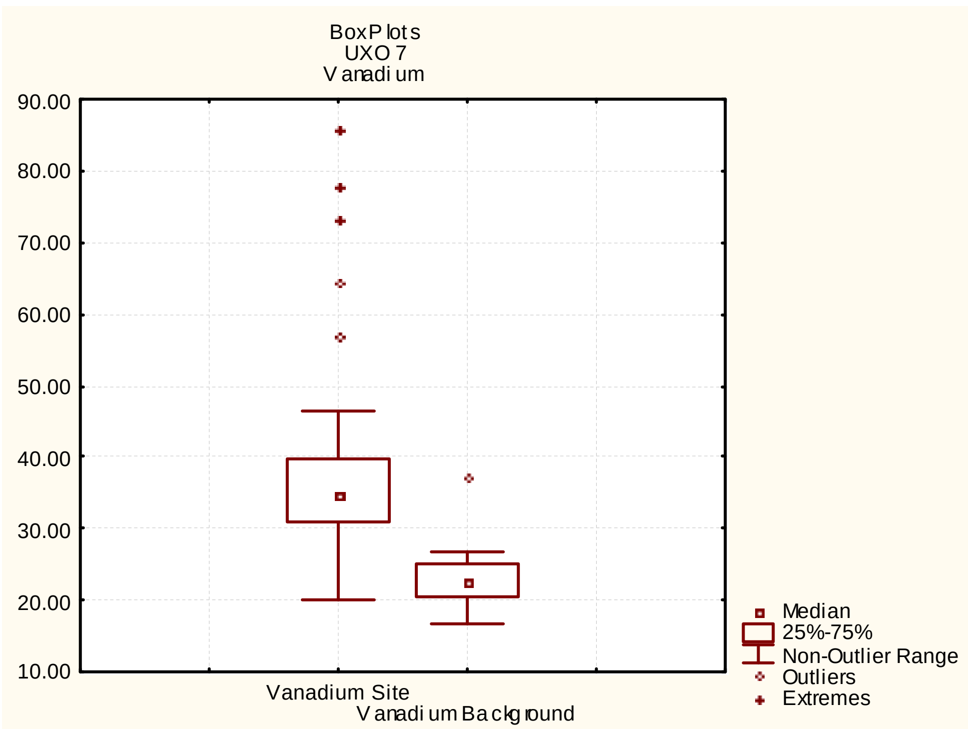


Figure 80

Figure 81 contains the side by side means plot for vanadium for UXO 7. From this plot it can be seen that the mean site concentration is higher than background concentration. The lower confidence limit for the site concentration is higher than the upper confidence limit for the background concentration.

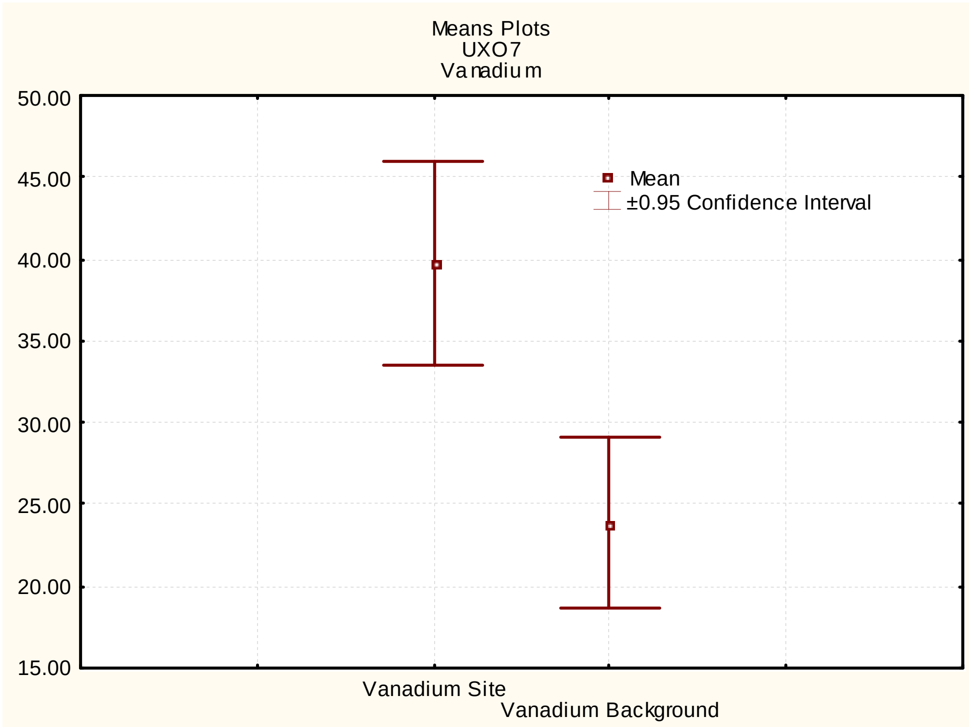


Figure 81

Figure 82 and 83 show the normal probability plots for the vanadium background and site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 82 it can be seen that the background data do not roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.10. Therefore it is concluded that the vanadium background data is not normally distributed. From Figure 83 it can be seen that the site data do not roughly follows the line and that the p value for the corresponding Shapiro Wilk test is 0.00. Therefore it is concluded that the vanadium data is not normally distributed.

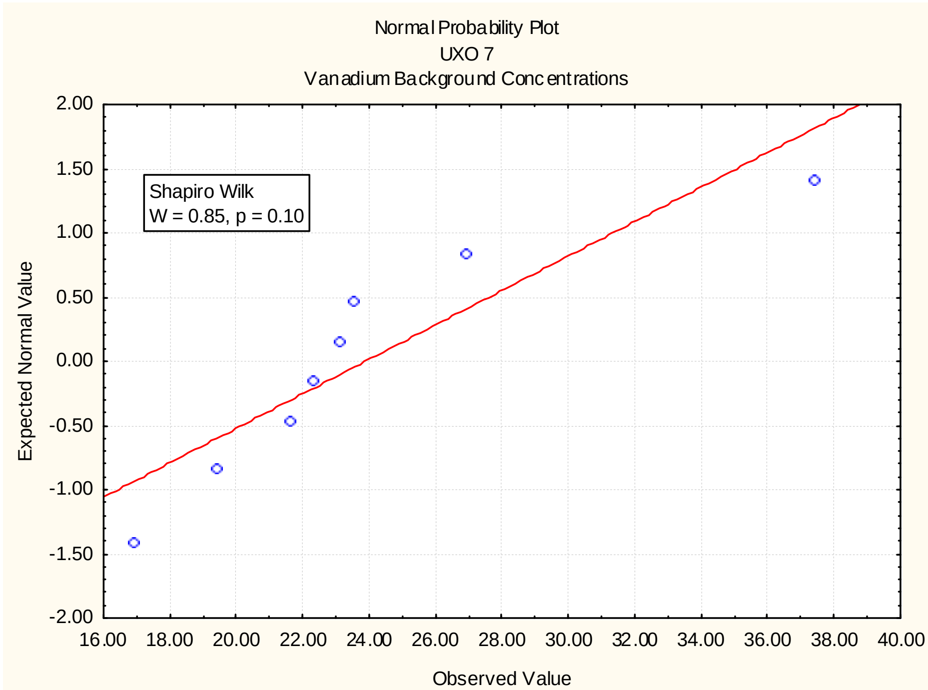


Figure 82

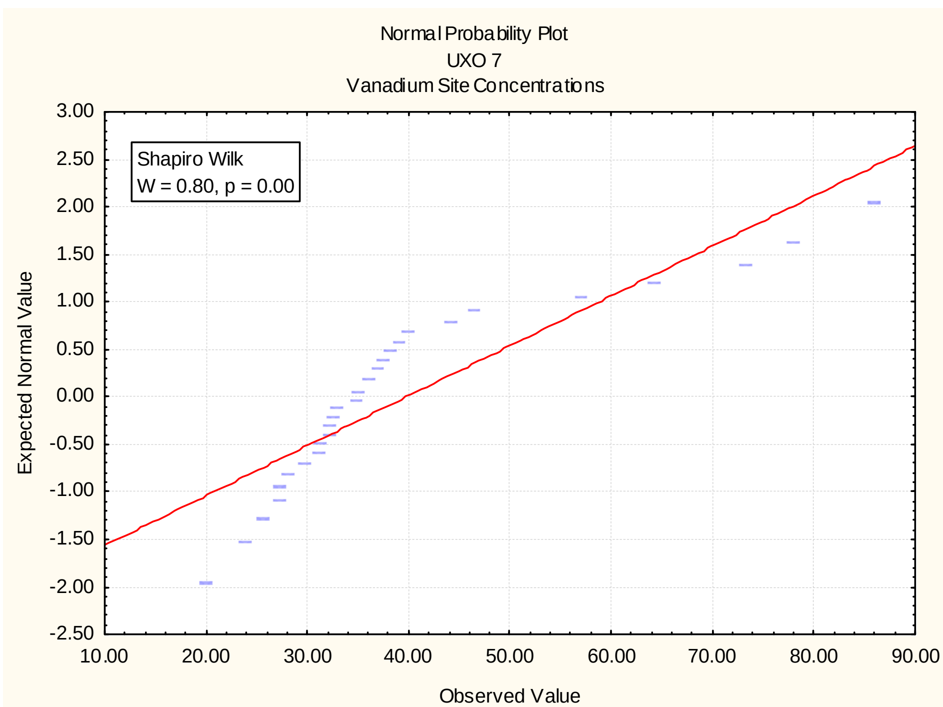


Figure 83

After examining the descriptive statistics, side by side box plots, means plots, and normality plot it can be concluded that the site vanadium concentrations are greater than the background vanadium concentrations.

Table 34 contains the descriptive statistics for zinc for UXO 7. From this table it can be seen that the mean, median, minimum, maximum, lower and upper quartile site concentrations are higher than the background concentrations.

Variable	Descriptive Statistics UXO 7							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Zinc Site	29	71.40	64.00	30.90	148.00	54.10	79.40	25.84
Zinc Background	8	35.96	36.15	15.10	60.20	31.10	38.95	12.60

Table 34

Figure 84 contains the side by side box plots for zinc. From this figure it can be seen that the site concentrations are greater than the background concentrations. The 25th percentile for the site concentration is higher than the upper whisker for the background concentrations.

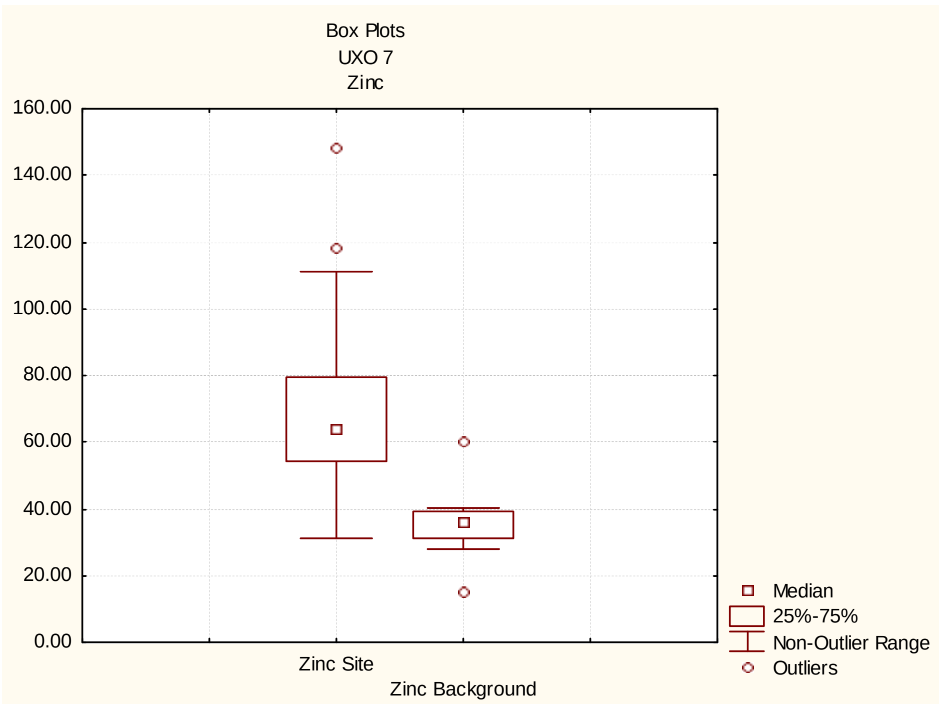


Figure 84

Figure 85 contains the side by side means plots for zinc. From this figure it can be seen that the site zinc concentrations are higher than the background concentrations. The lower confidence limit on the site zinc concentration is higher than the upper confidence limit of the background zinc concentration.

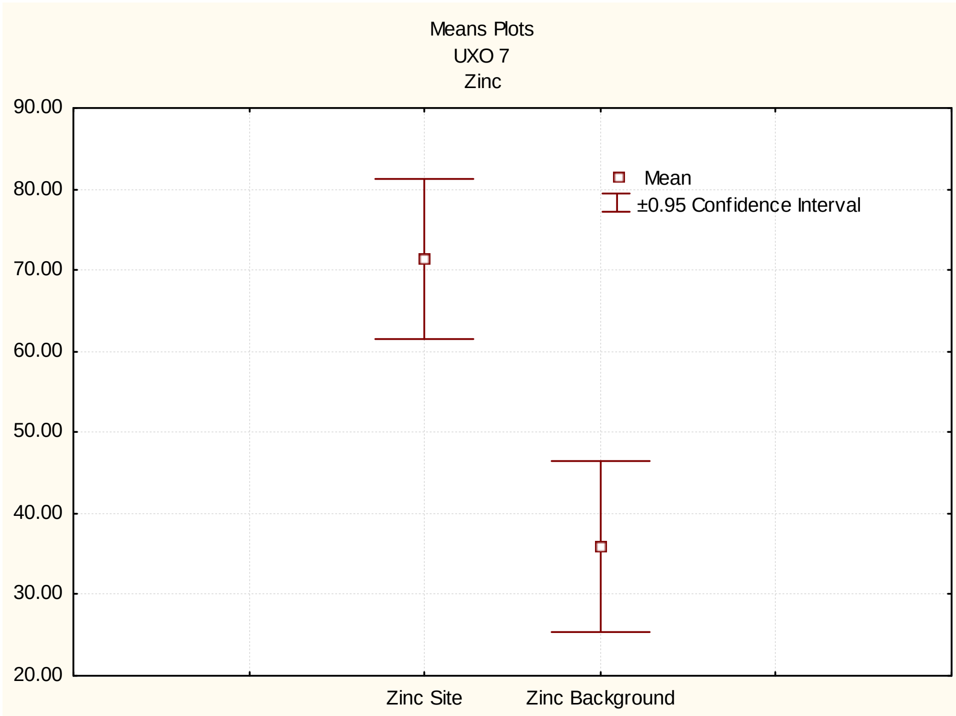


Figure 85

Figure 86 and 87 show the normal probability plots for the zinc background and site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 86 it can be seen that the background data roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.38. Therefore it is concluded that the zinc background data is not normally distributed. From Figure 86 it can be seen that the background data roughly follows the line and that the p value for the corresponding Shapiro Wilk test is 0.38. Therefore it is concluded that the zinc background data is roughly normally distributed. From figure 87 it can be seen that that the data do not roughly follow the line and the corresponding pvalue for the Shapiro Wilk test is 0.03. Therefore it can be concluded that the site data is not normally distributed.

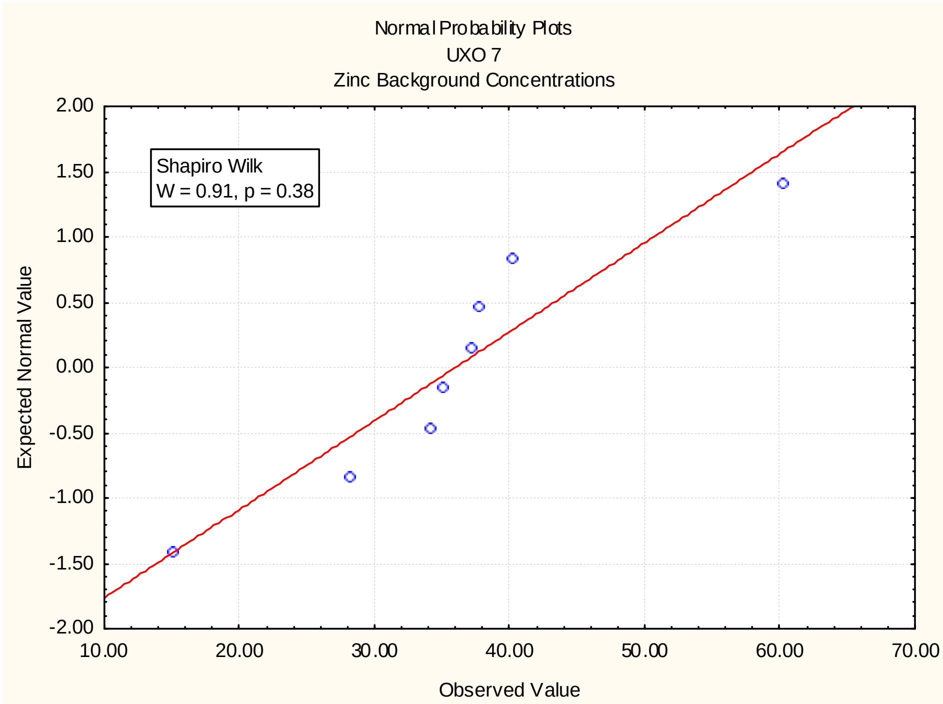


Figure 86

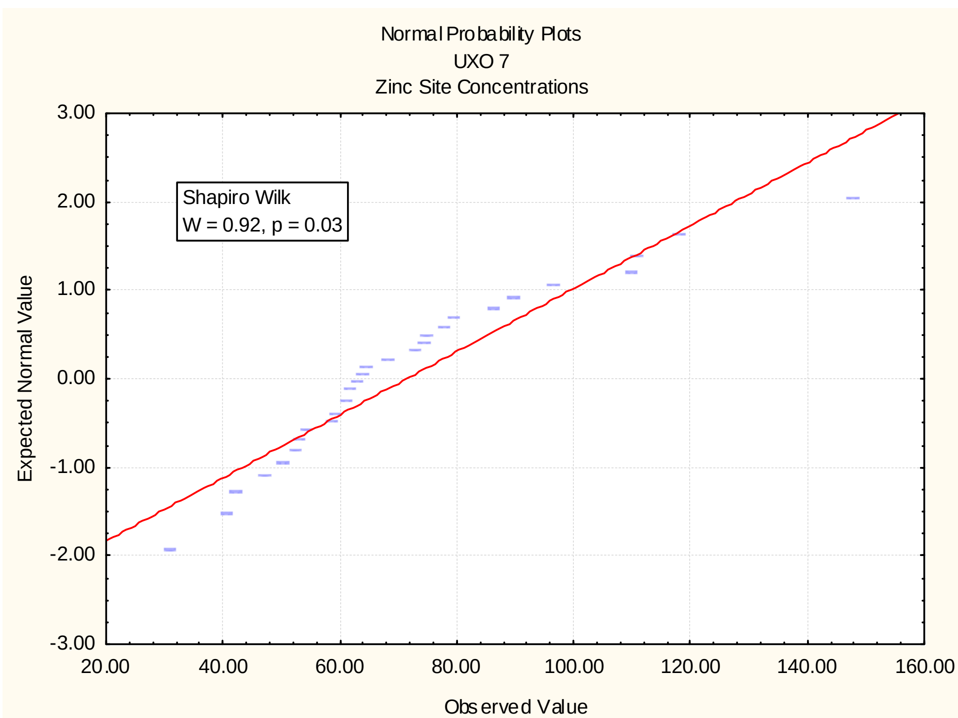


Figure 87

After examining the descriptive statistics, side by side box plots, means plots, and normality plot it can be concluded that the site zinc concentrations are greater than the background zinc concentrations.

The following lead concentrations were obtained by using the lab results and the converted XRF concentrations to lab results. The site was then divided into three locations (Area 1, 2, and 3). Table 35 contains the descriptive statistics for area 1 and the background lead concentrations. From this table it can be seen that the mean, median, maximum, lower and upper quartile area 1 concentrations are higher than the background concentrations.

Variable	Descriptive Statistics UXO 7							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Area 1	50	72.53	42.95	10.00	537.00	24.00	68.00	99.63
Background	8	15.89	15.45	12.30	20.60	13.25	18.40	3.10

Table 35

Figure 88 contains the side by side box plots. From this figure it can be seen that the area 1 lower quartile is approximately equal to the upper quartile of the background concentration.

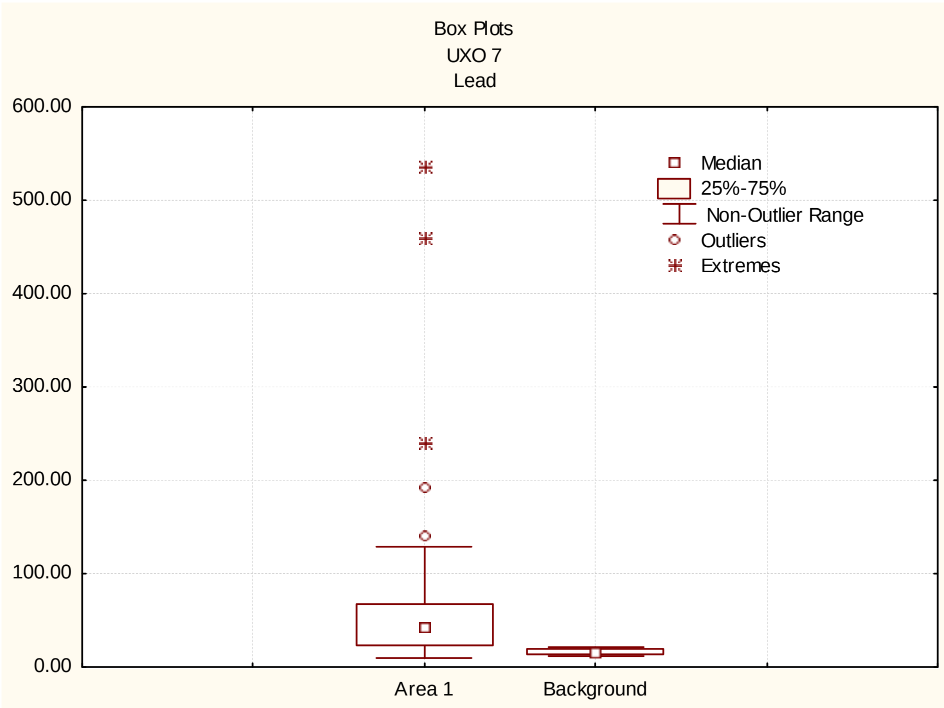


Figure 88

Figure 89 contains the side by side means plots. From this plot it can be seen that the area 1 mean concentrations is higher than the background concentration.

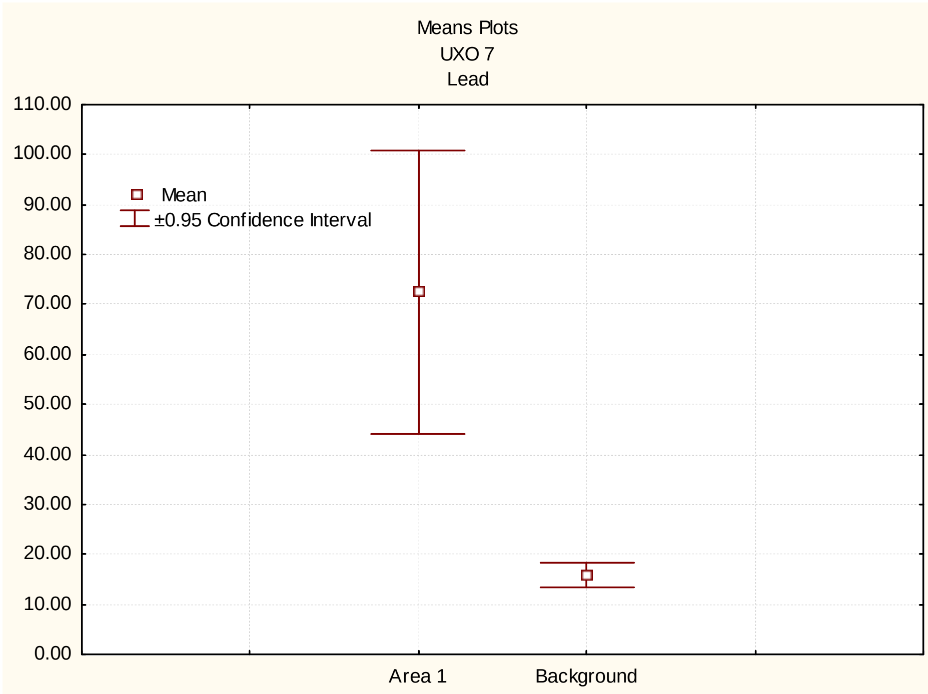


Figure 89

Figure 90 shows the normal probability plots for the area 1 concentration. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plots are the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 90 it can be seen that the area 1 data do not roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.00. Therefore it is concluded that the area 1 data is not normally distributed.

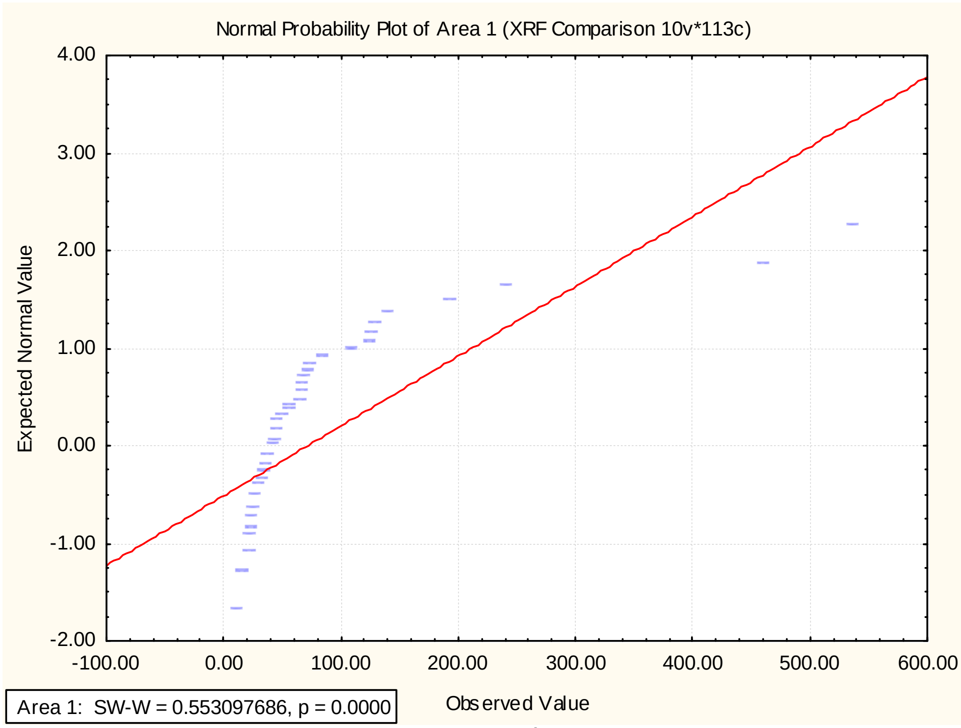


Figure 90

After examining the descriptive statistics, side by side box plots, means plots, and normality plot it can be concluded that the area 1 lead concentrations are greater than the background lead concentrations.

Table 36 contains the descriptive statistics for area 2 and background concentrations. From this table it can be seen mean, median, minimum, maximum, and upper quartile area 2 concentrations are greater than the background concentrations.

	Descriptive Statistics UXO 7							
Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Area 2	105	24.21619	26.00000	10.00000	99.00000	10.00000	32.00000	12.63895
Background	8	15.88750	15.45000	12.30000	20.60000	13.25000	18.40000	3.09767

Table 36

Figure 91 contains the side by side box plots for area 2 and the background concentrations. From this figure it can be seen that the area 2 median and upper quartile are greater than the background median and upper quartile.

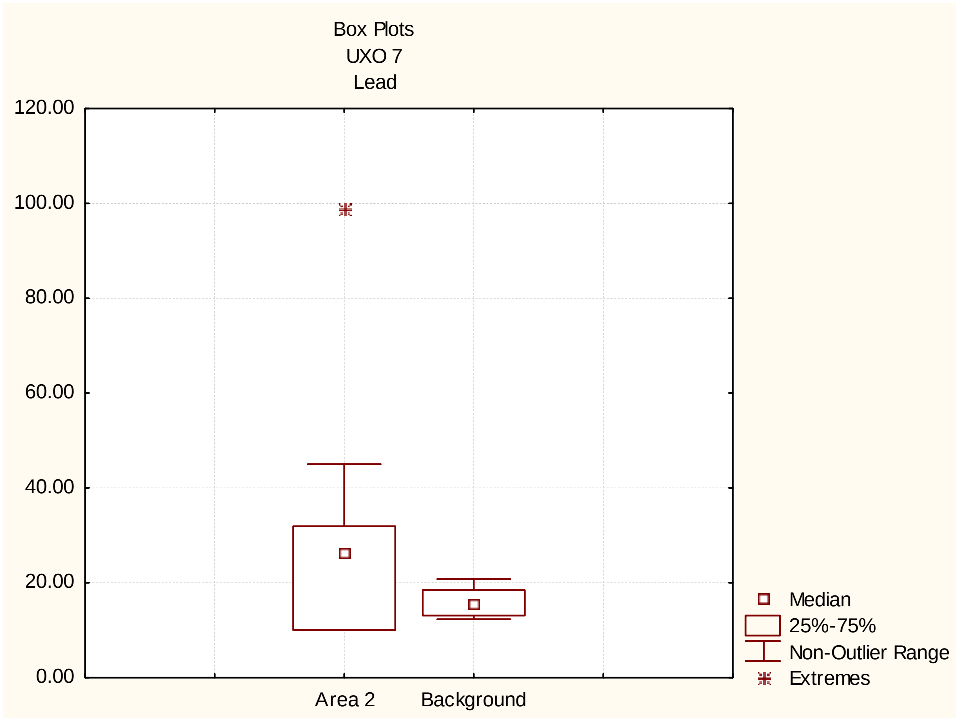


Figure 91

Figure 92 contains the side by side means plots for the area 2 and background concentrations. From this figure it can be seen that the area 2 lower confidence limit it greater than the upper confidence limit for the background concentrations.

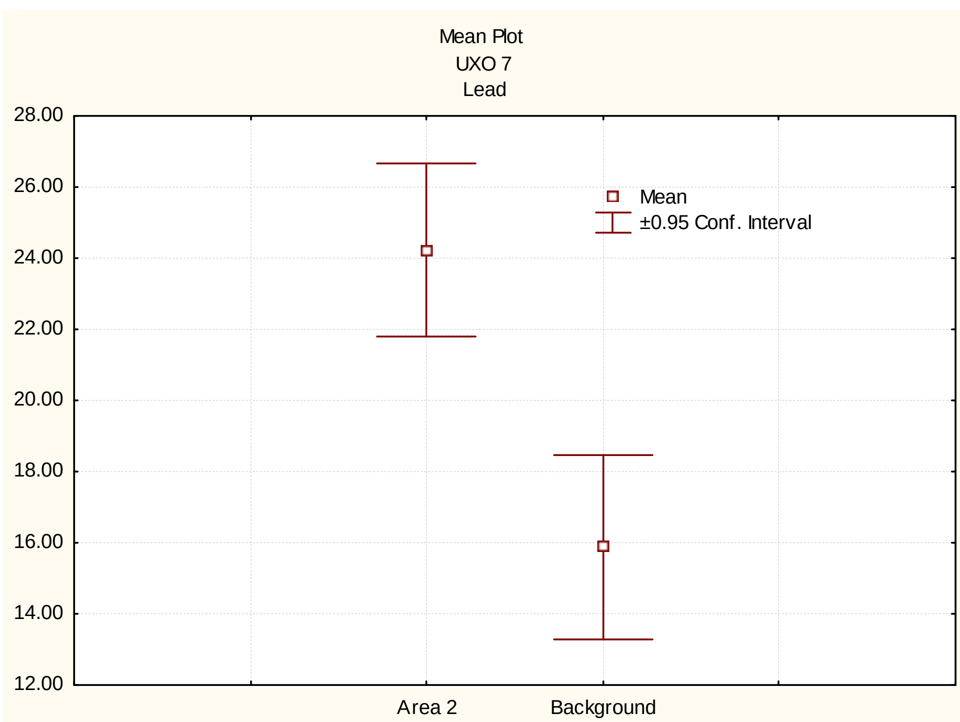


Figure 92

Figure 93 contains the area 2 normal probability plot. From this plot it can be seen that the data do not roughly follow the normal distribution and the pvalue for the corresponding Shapiro wilk test is 0.00. Thus it is concluded that the area 2 concentrations are not normally distributed.

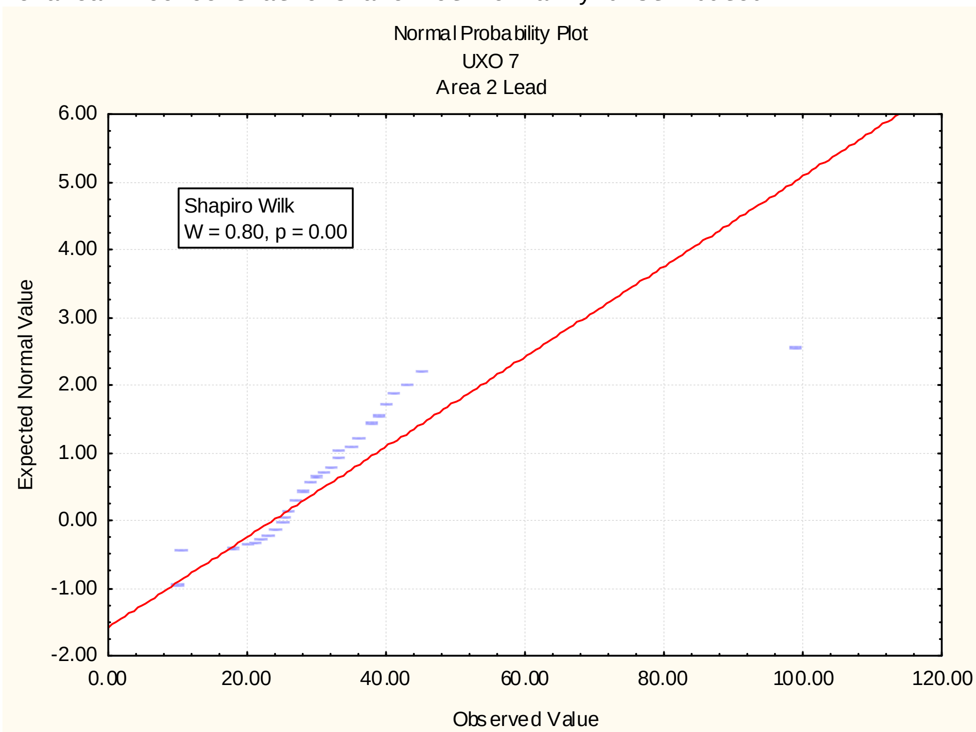


Figure 93

After examining the descriptive statistics, side by side box plots, means plots, and normality plot it can be concluded that the area 2 concentrations are greater than the background lead concentrations.

Table 37 contains the descriptive statistics for area 3 and the background concentrations. From this table it can be seen that the mean, median, maximum, lower and upper quartile area 3 concentrations are greater than the background concentration.

	Descriptive Statistics UXO 7							
Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Area 3	34	182.3147	92.05000	10.00000	1160.000	30.00000	199.0000	268.6587
Background	8	15.8875	15.45000	12.30000	20.600	13.25000	18.4000	3.0977

Table 37

Figure 94 contains the side by side box plots for area 3 and the background concentrations. From this plot it can be seen that the lower quartile area 3 concentrations are greater than the upper quartile background concentrations.

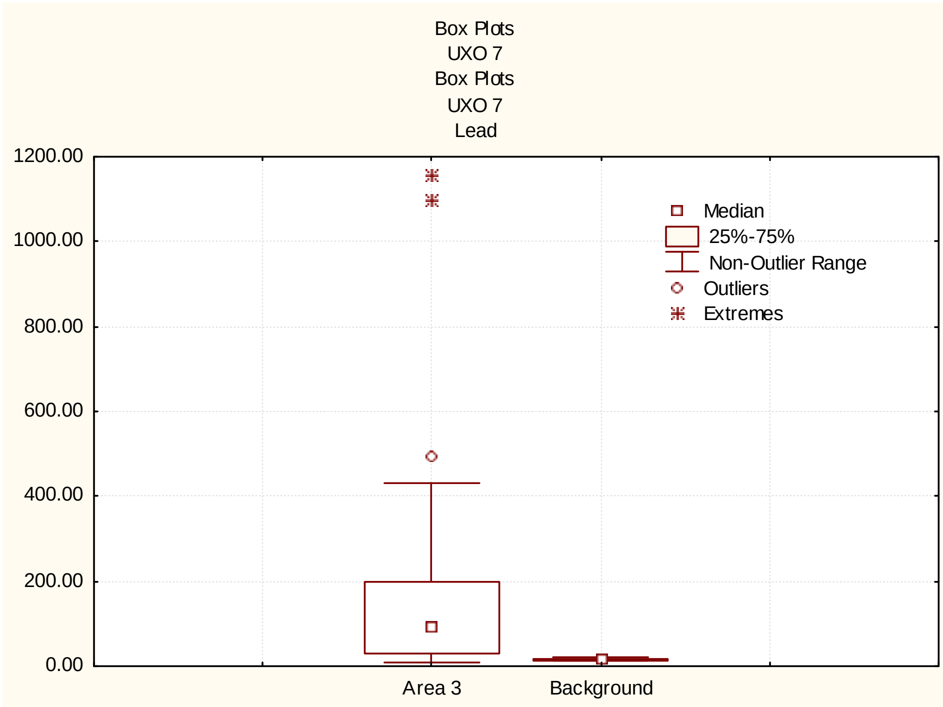


Figure 94

Figure 95 contains the side by side means plots for area 3 and the background concentrations. From this plot it can be seen that the area 3 concentration is greater than the background mean concentration. It can also be seen that the lower confidence limit for the area 3 concentrations is higher than the upper confidence limit for the background 3 concentrations.

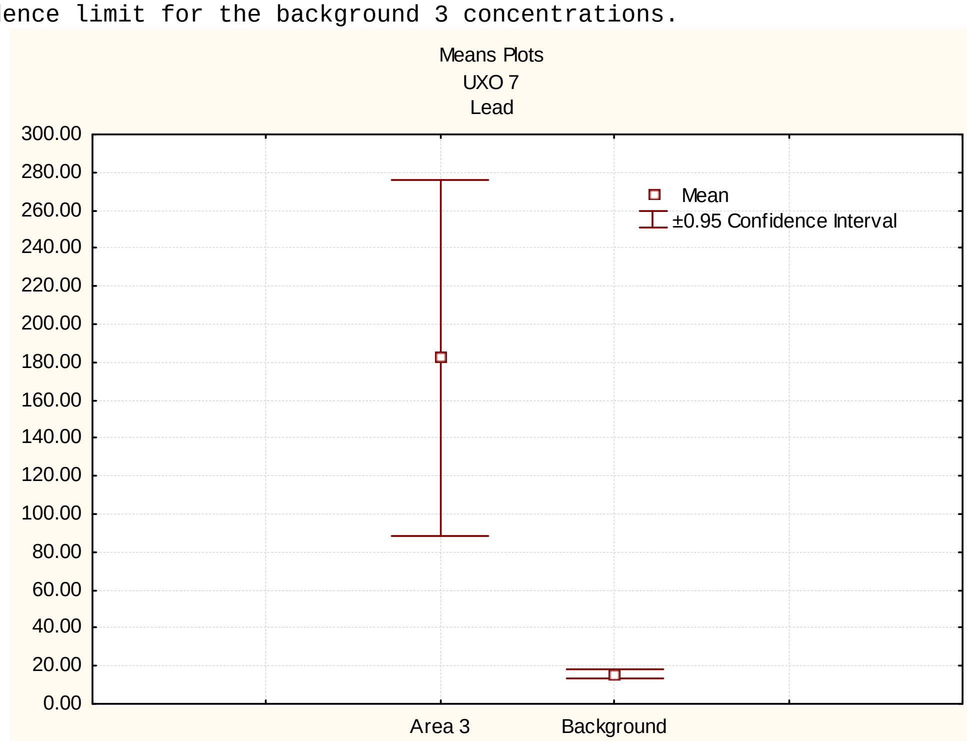


Figure 95

Figure 96 contains the normal probability plot for the area 3 lead concentrations. From this plot it can be seen that the data do not follow the line and that the corresponding pvalue for the Shapiro Wilk test is 0.00. Therefore the area 3 concentrations are not normally distributed.

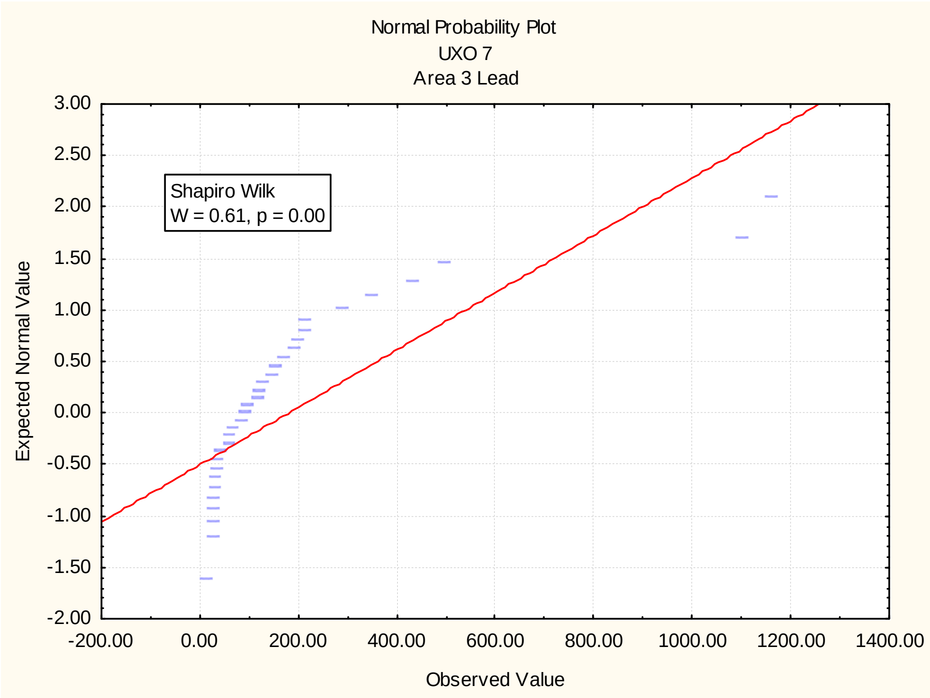
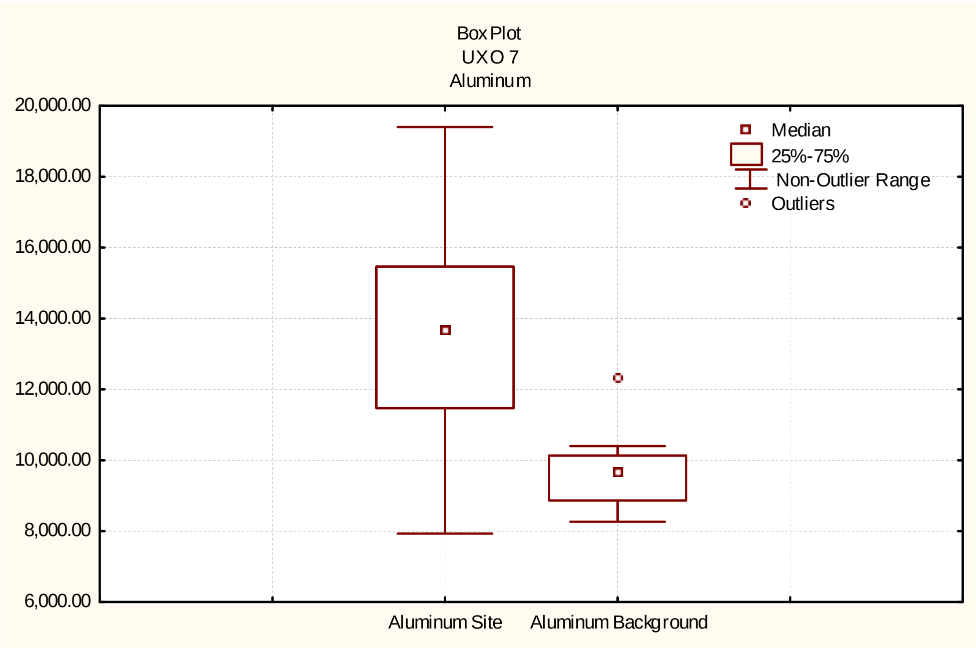
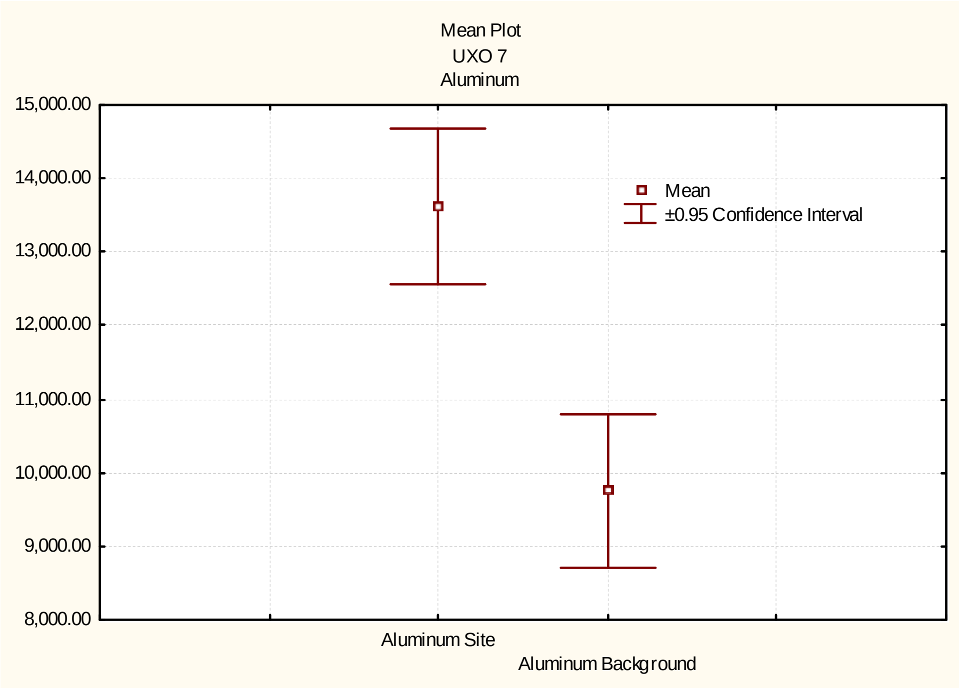


Figure 96

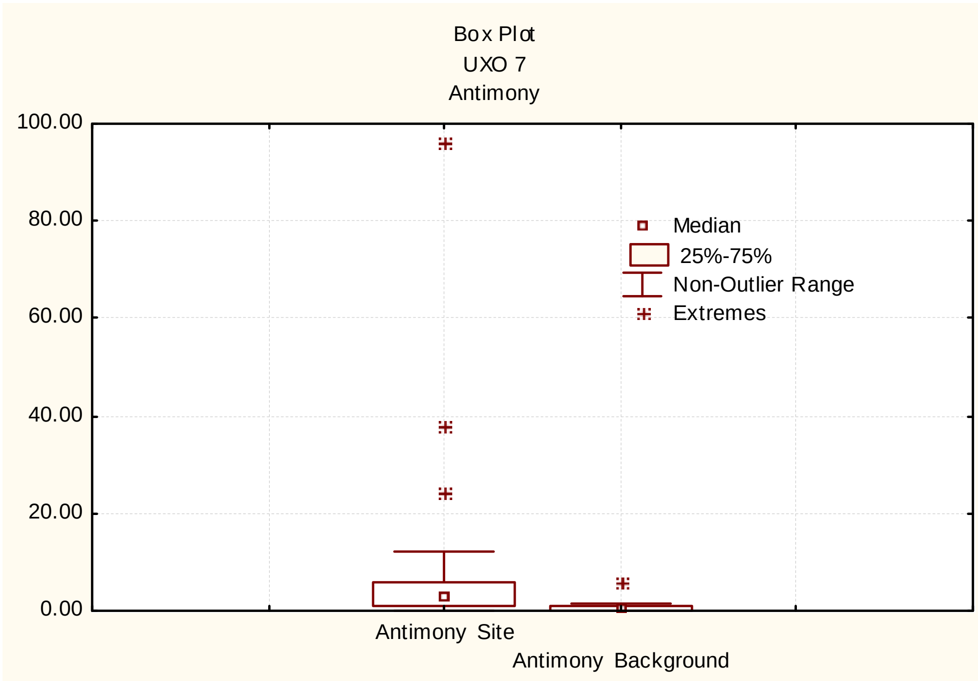
After examining the descriptive statistics, side by side box plots, means plots, and normality plot it can be concluded that the area 3 concentrations are greater than the background lead concentrations.

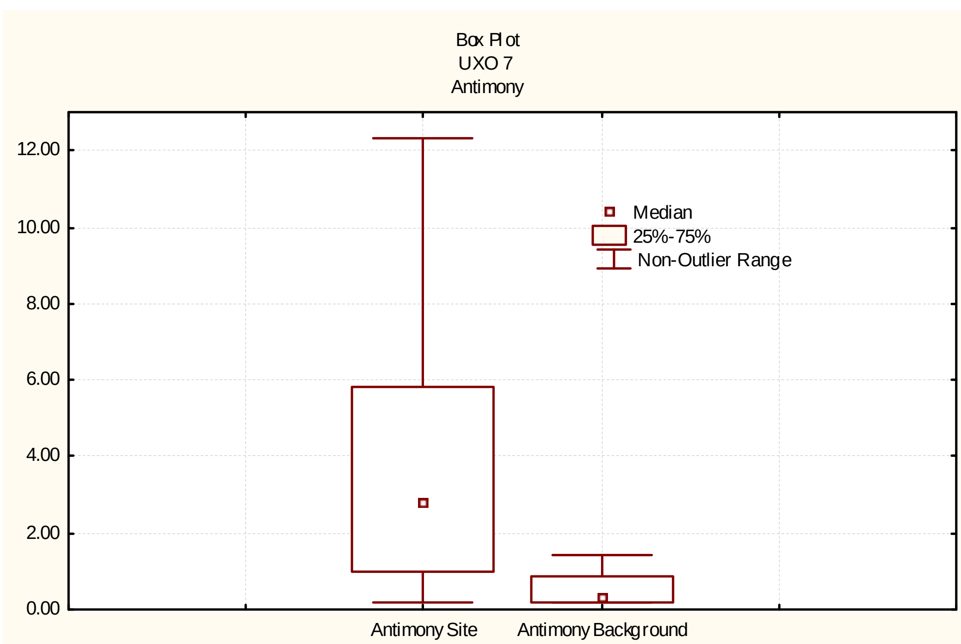
Variable	Descriptive Statistics UXO 7							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Aluminum Site	33	13629.09	13700.00	7910.000	19400.00	11500.00	15500.00	2968.431
Aluminum Background	8	9751.25	9700.00	8240.000	12300.00	8885.00	10150.00	1260.810

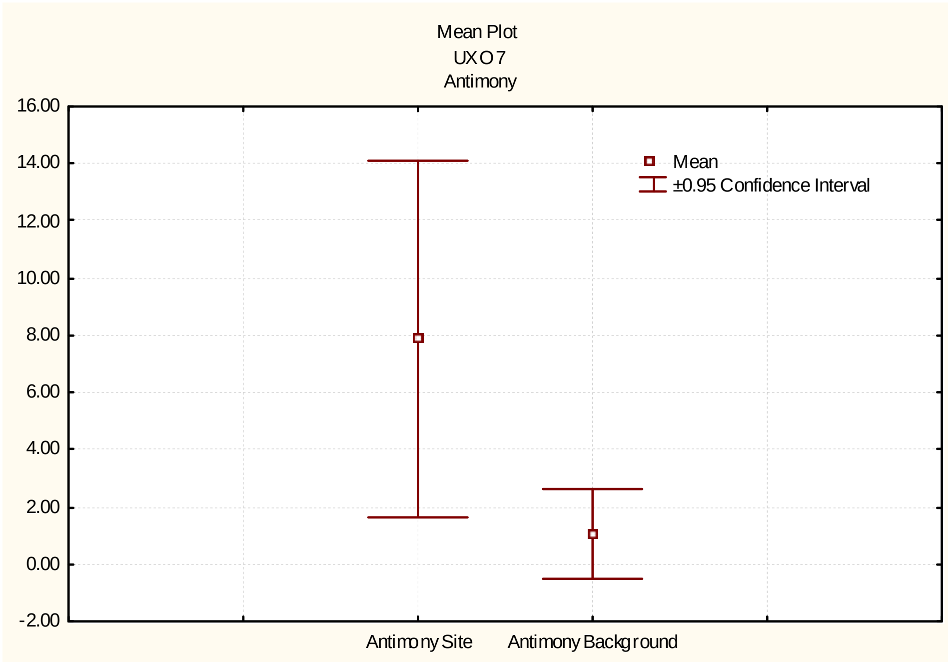




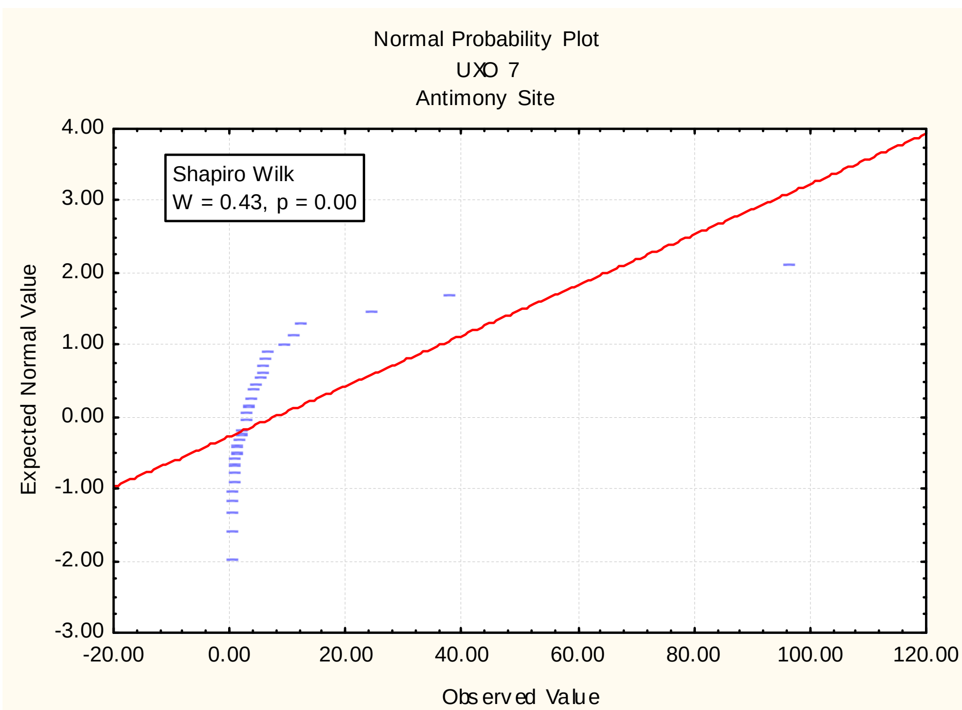
Variable	Descriptive Statistics UXO 7 Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Antimony Site	33	7.896818	2.800000	0.190000	96.20000	0.980000	5.800000	17.57337
Antimony Background	8	1.063125	0.287500	0.180000	5.60000	0.197500	0.877500	1.87803



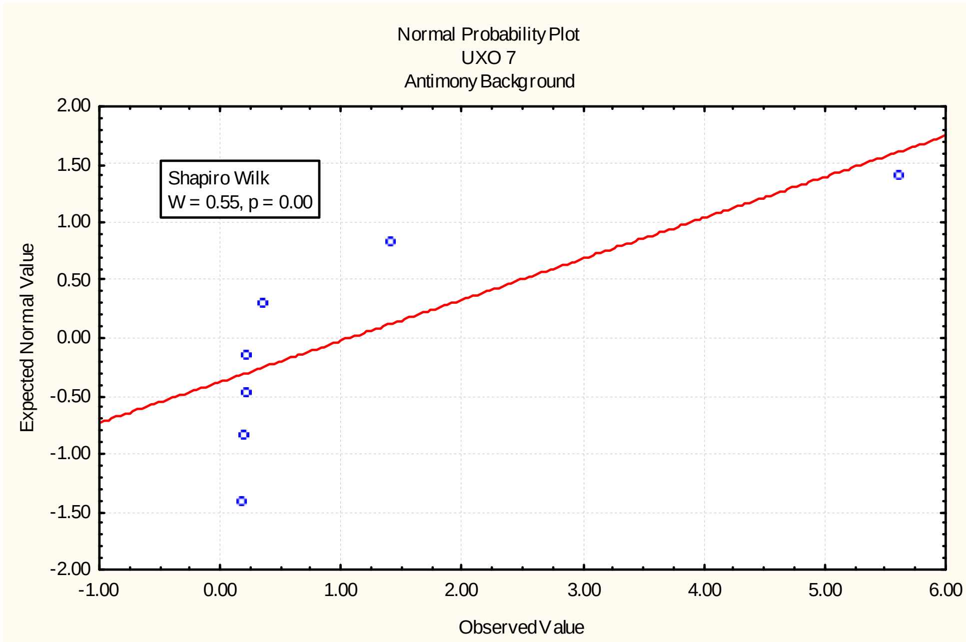




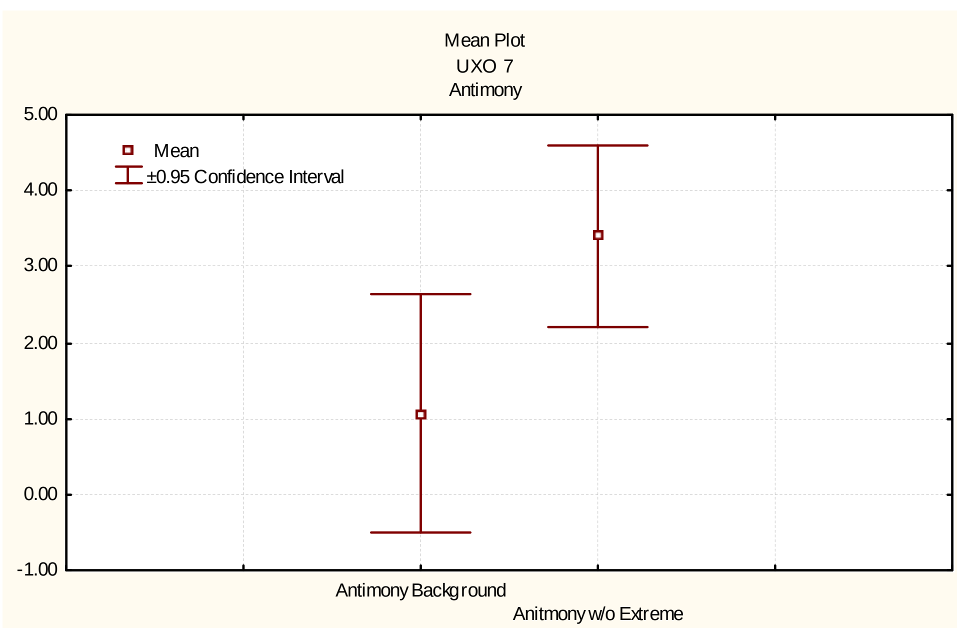
Mean Plot
UXO 7
Antimony
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
Mean
±0.95 Confidence Interval
Antimony Site
Antimony Background

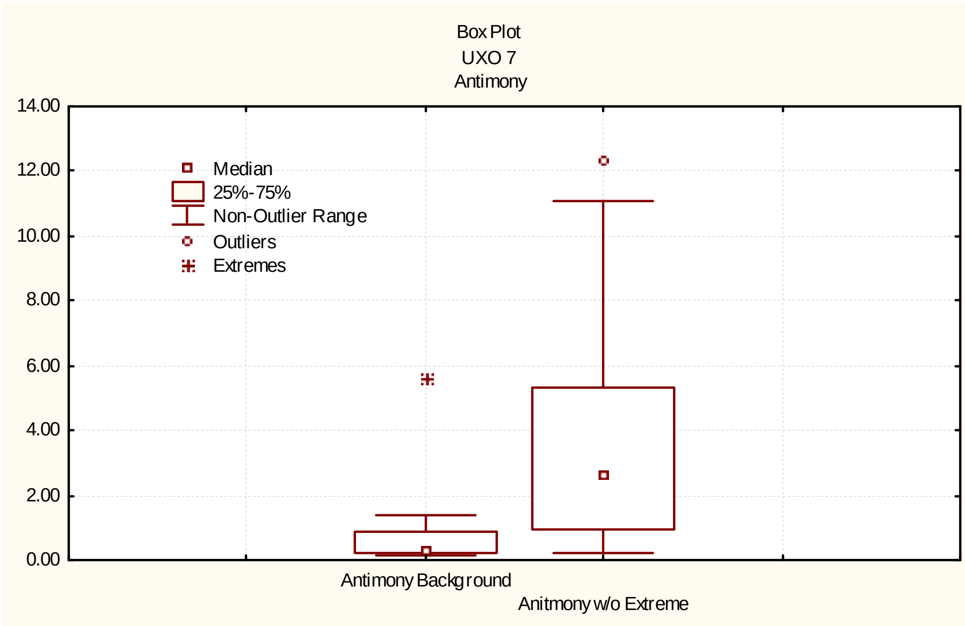


Normal Probability Plot
UXO 7
Antimony Site
Shapiro Wilk
W = 0.43, p = 0.00
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
Expected Normal Value
-20.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
Observed Value

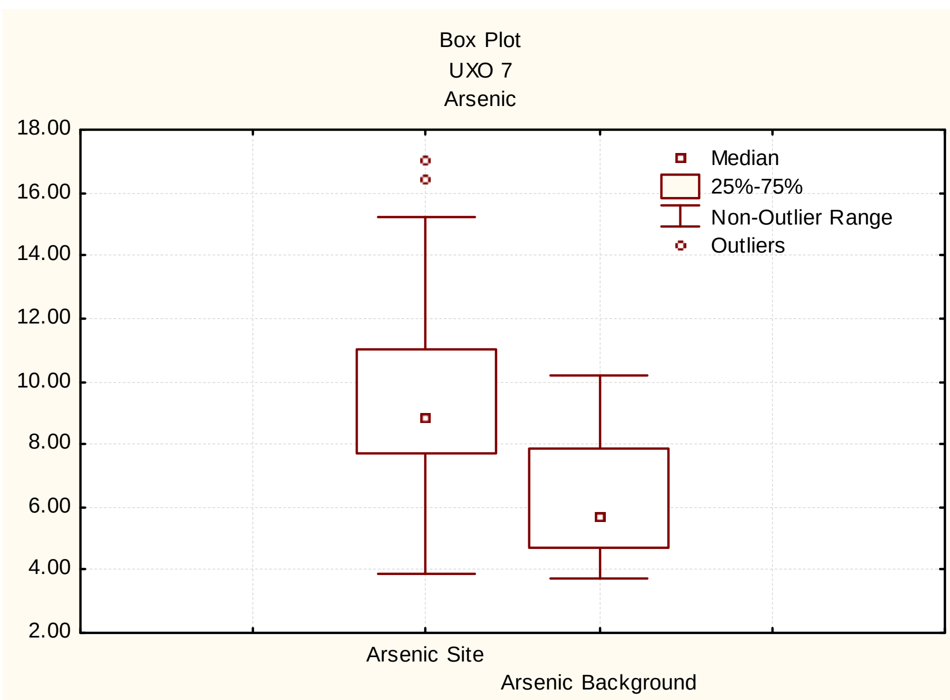


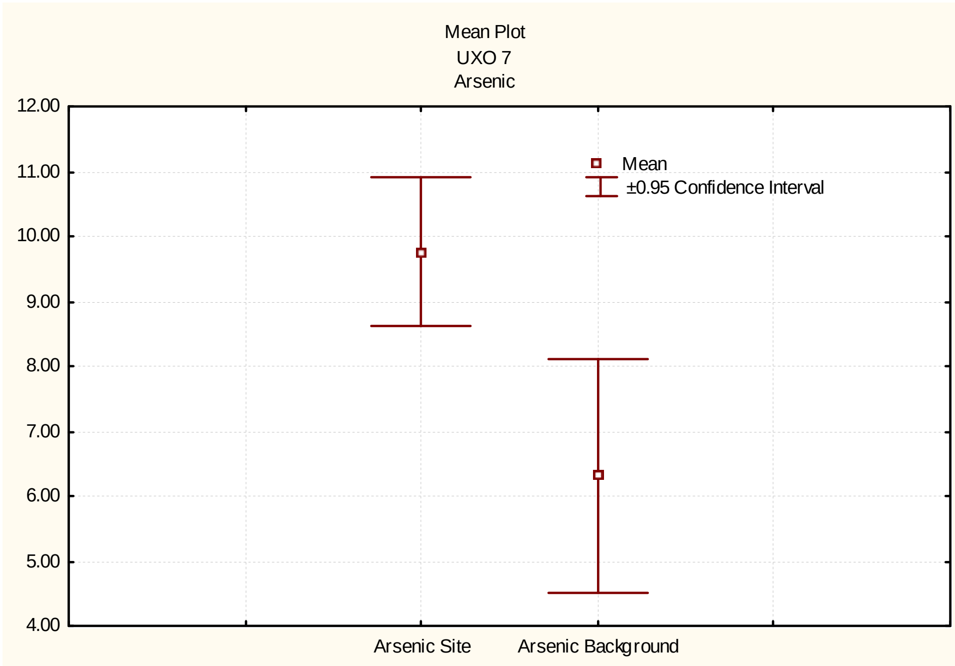
Variable	Descriptive Statistics (Spreadsheet1) Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Antimony Background	8	1.063125	0.287500	0.180000	5.60000	0.197500	0.877500	1.878035
Anitmony w/o Extreme	30	3.399833	2.600000	0.190000	12.30000	0.930000	5.300000	3.228938

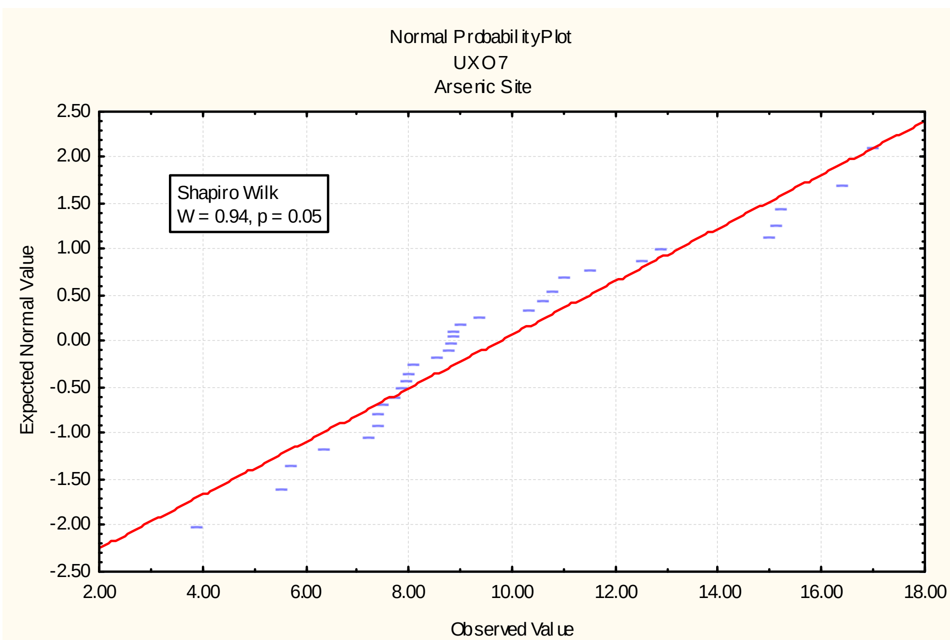


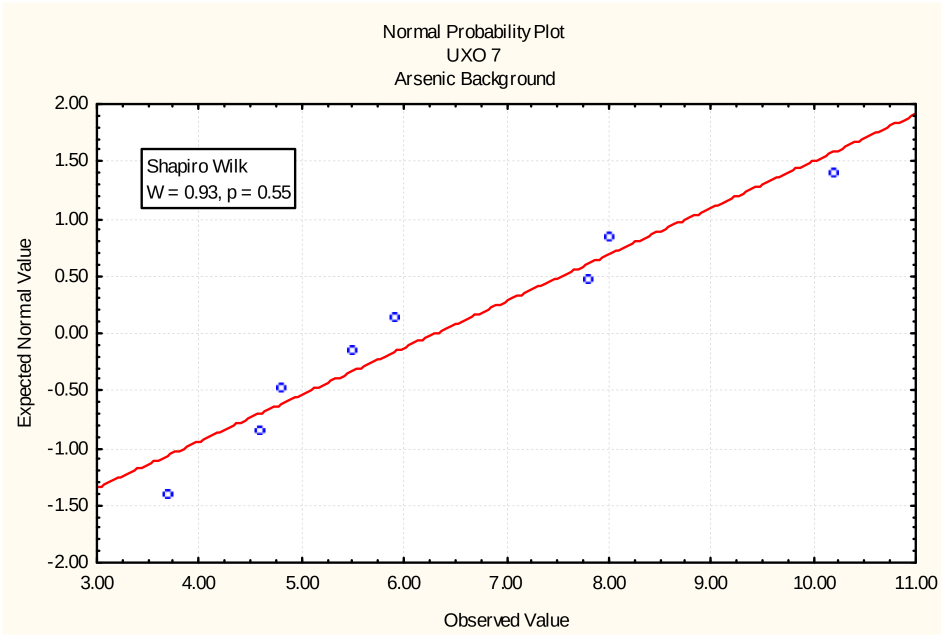


Variable	Descriptive Statistics UXO 7							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Arsenic Site	33	9.750000	8.840000	3.860000	17.00000	7.720000	11.00000	3.230200
Arsenic Background	8	6.312500	5.700000	3.700000	10.20000	4.700000	7.90000	2.172844

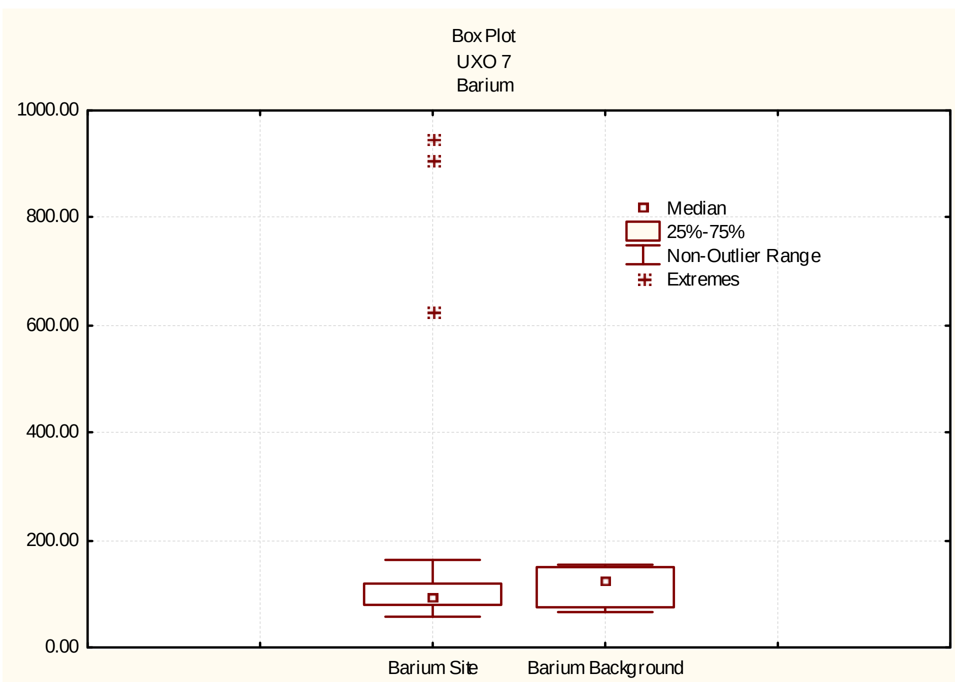


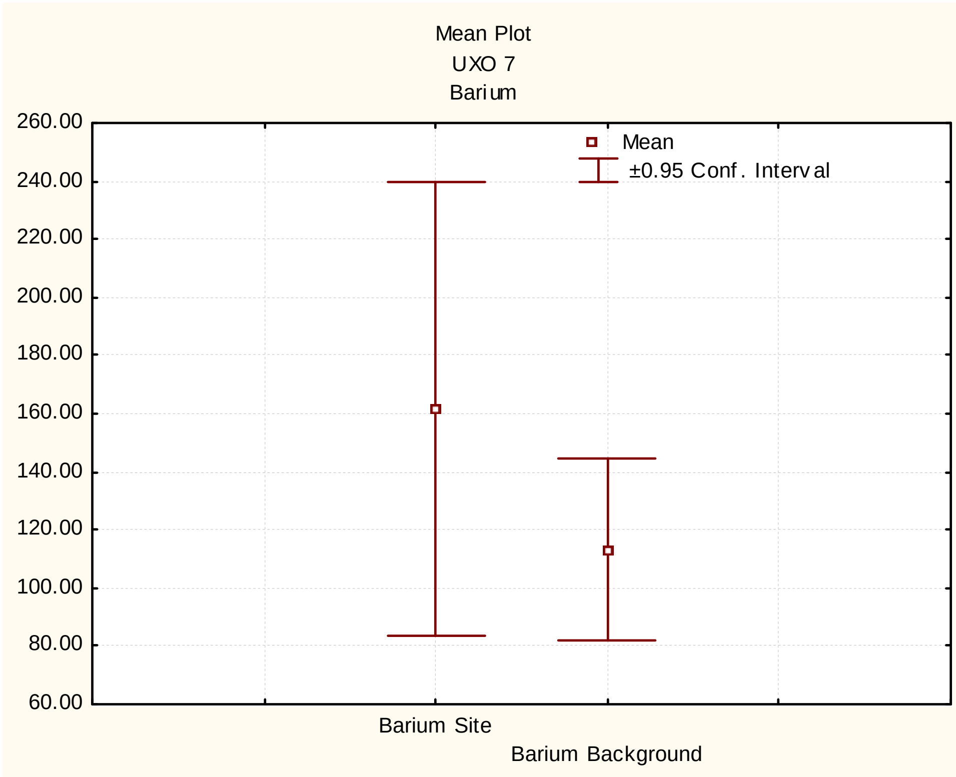

Mean Plot
UXO 7
Arsenic
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
Mean
±0.95 Confidence Interval
Arsenic Site
Arsenic Background


Normal Probability Plot
UXO 7
Arsenic Site
Shapiro Wilk
W = 0.94, p = 0.05
Expected Normal Value
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Observed Value

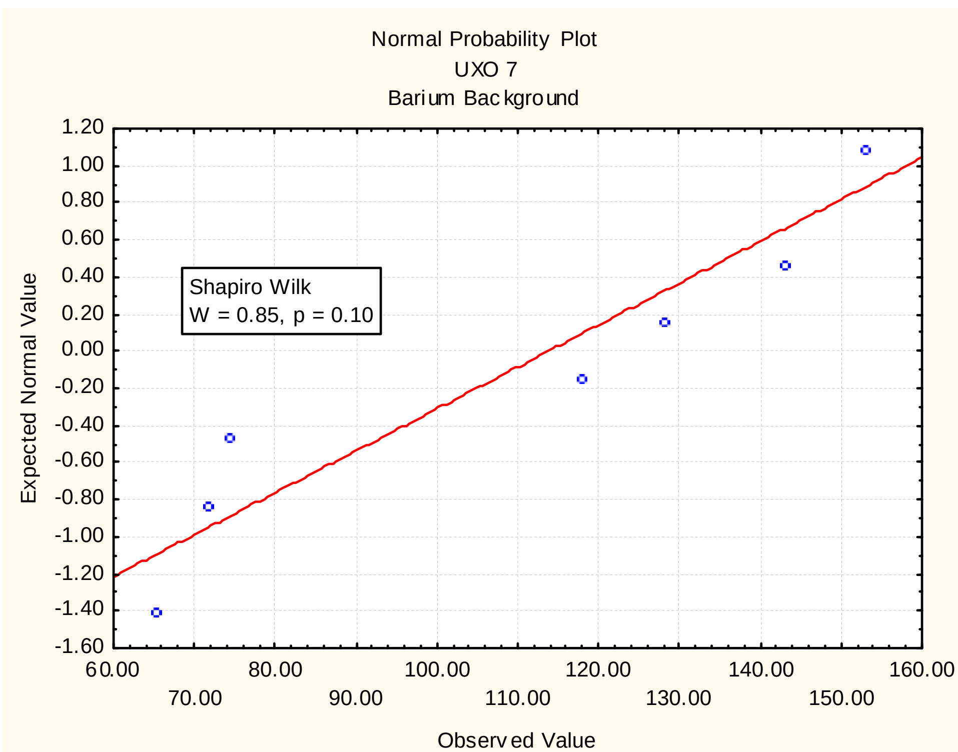


Variable	Descriptive Statistics UXO 7							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Barium Site	33	161.3212	91.2000	56.20000	949.0000	80.90000	118.0000	220.1375
Barium Background	8	113.2875	123.0000	65.20000	153.0000	73.05000	148.0000	37.4725

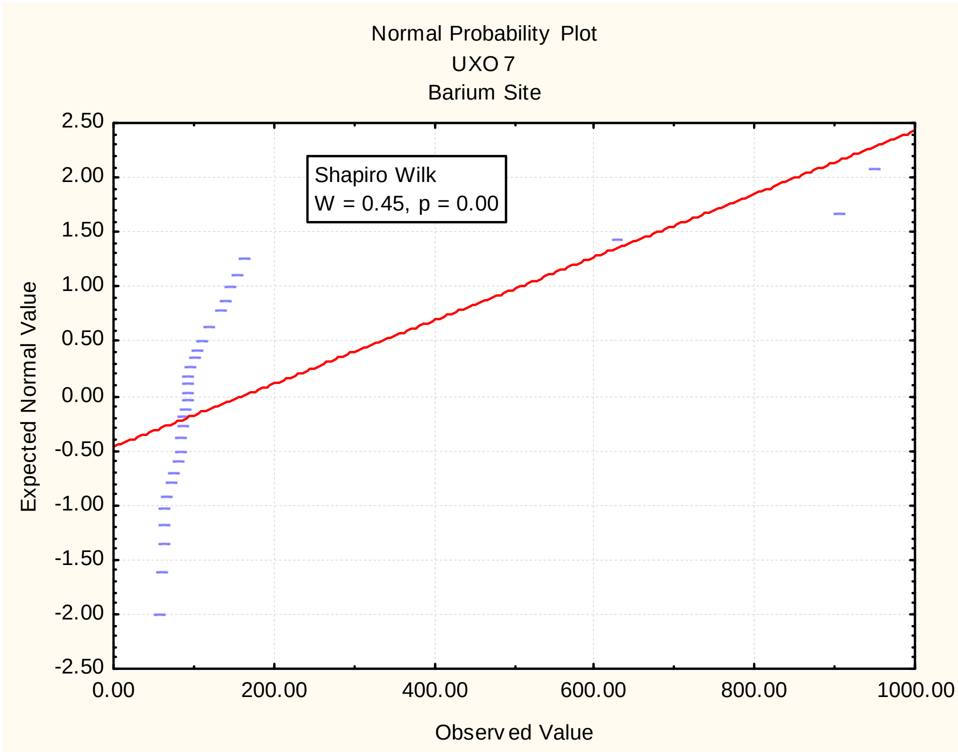




Mean Plot
UXO 7
Barium
260.00
240.00
220.00
200.00
180.00
160.00
140.00
120.00
100.00
80.00
60.00
Mean
±0.95 Conf. Interval
Barium Site
Barium Background



Normal Probability Plot
UXO 7
Barium Background
Shapiro Wilk
W = 0.85, p = 0.10
Expected Normal Value
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
-1.20
-1.40
-1.60
60.00
70.00
80.00
90.00
100.00
110.00
120.00
130.00
140.00
150.00
160.00
Observed Value

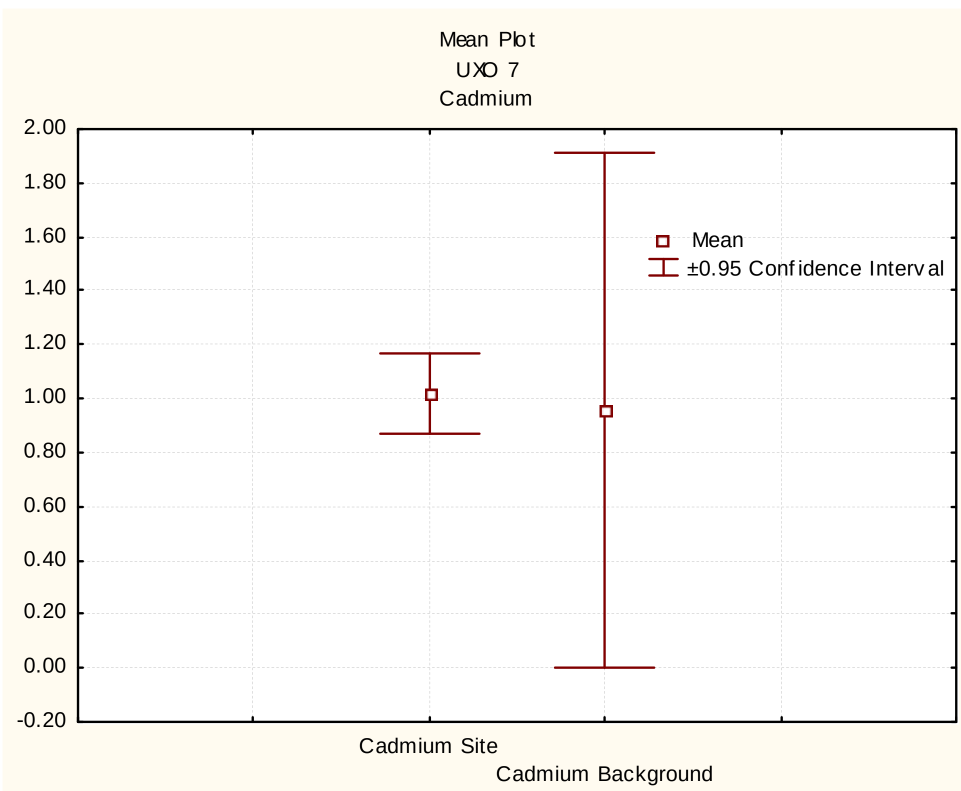


Variable	T-tests; Grouping: Barium Group (Inorganics Comparison) Group 1: Site Group 2: Background Mean Site	Mean Background	t-value	df	p	Valid N Site	V Ba
Barium Comparison	161.3212	113.2875	0.609323	39	0.545844	33	

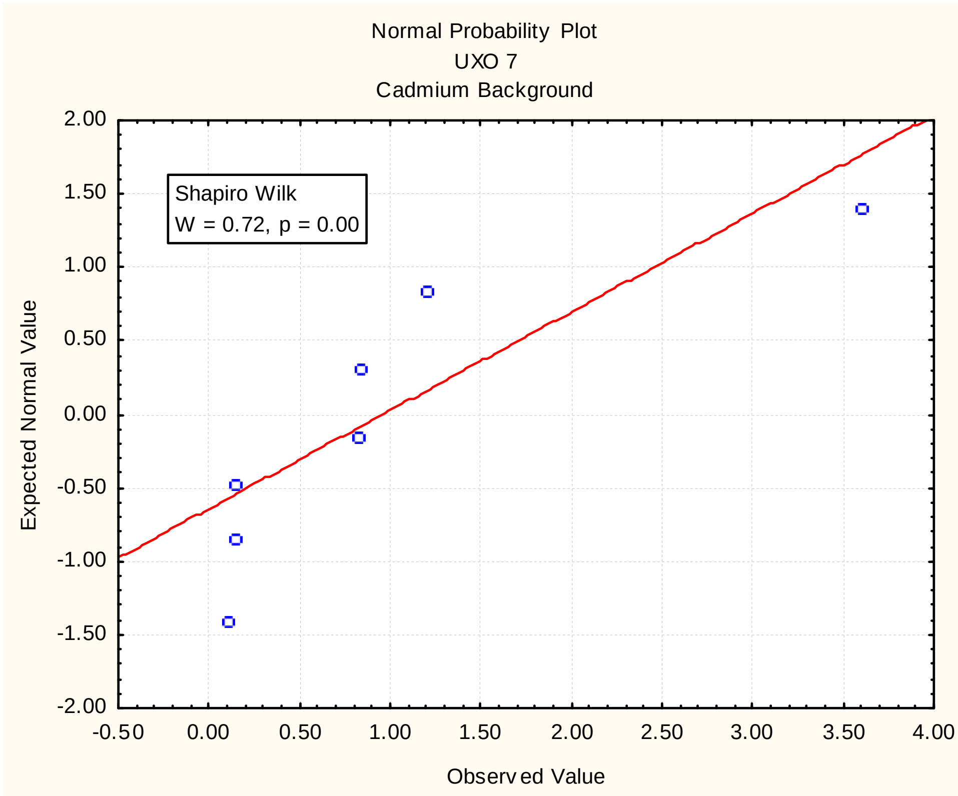
variable	Mann-Whitney U Test (Inorganics Comparison) By variable Barium Group Marked tests are significant at p <.05000 Rank Sum Site	Rank Sum Background	U	Z	p-level	a
Barium Comparison	672.0000	189.0000	111.0000	-0.690849	0.489661	-0

Variable	Descriptive Statistics UXO 7 Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Cadmium Site	33	1.020848	0.959000	0.387000	2.210000	0.689000	1.270000	0.420970
Cadmium Background	8	0.958125	0.825000	0.100000	3.600000	0.142500	1.015000	1.143728

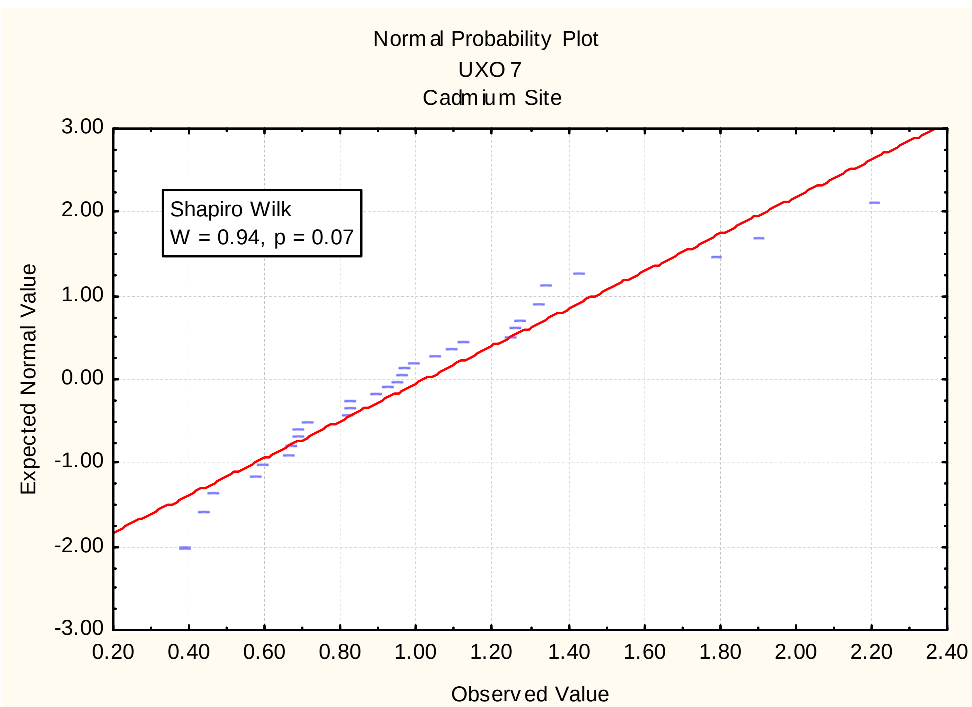
Box Plot
UXO 7
Cadmium
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Median
25%-75%
Non-Outlier Range
Outliers
Cadmium Site
Cadmium Background



Mean Plot
UXO 7
Cadmium
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
Mean
±0.95 Confidence Interval
Cadmium Site
Cadmium Background

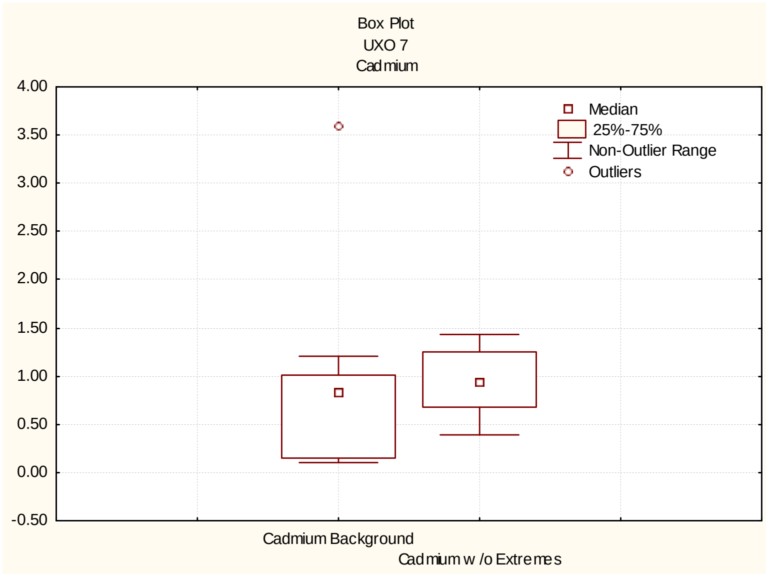


Normal Probability Plot
UXO 7
Cadmium Background
Shapiro Wilk
W = 0.72, p = 0.00
2.00
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-0.50
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
Expected Normal Value
Observed Value

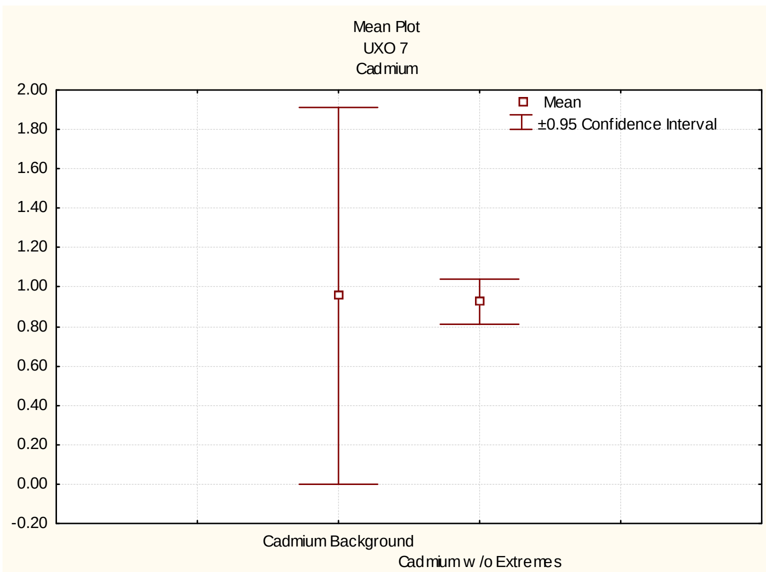


Normal Probability Plot
UXO 7
Cadmium Site
Shapiro Wilk
W = 0.94, p = 0.07
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
2.20
2.40
Expected Normal Value
Observed Value

Variable	Descriptive Statistics UXO 7							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Cadmium Background	8	0.958125	0.825000	0.100000	3.600000	0.142500	1.015000	1.143728
Cadmium w/o Extremes	30	0.926267	0.936000	0.387000	1.430000	0.683000	1.250000	0.300801



Box Plot
UXO 7
Cadmium
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
Median
25%-75%
Non-Outlier Range
Outliers
Cadmium Background
Cadmium w /o Extremes



Mean Plot
UXO 7
Cadmium
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
Mean
±0.95 Confidence Interval
Cadmium Background
Cadmium w /o Extremes

order	001	002	003	004	005	006	007	008	009	010	011
nsample	X7SS0010002	X7SS0020002	X7SS0030002	X7SS0040002	X7SS0050002	X7SS0060002	X7SS0060002-D	X7SS0070002	X7SS0080002	X7SS0090002	X7SS0090002-D
location	X7-SB001	X7-SB002	X7-SB003	X7-SB004	X7-SB005	X7-SB006	X7-SB006	X7-SB007	X7-SB008	X7-SB009	X7-SB009
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0010002	X7SS0020002	X7SS0030002	X7SS0040002	X7SS0050002	X7SS0060002	X7SS0060002D	X7SS0070002	X7SS0080002	X7SS0090002	X7SS0090002D
sample_dat	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate							X7SS0060002				X7SS0090002
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_001	c_002	c_003	c_004	c_005	c_006	c_007	c_008	c_009	c_010	c_011
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM		12800	7910	8600							
ANTIMONY		0.71 U	5.8 J	11.1 J							
ARSENIC		12.9	16.4	9.34							
BARIUM		110	907	949							
BERYLLIUM		0.82	1.35	0.67							
CADMIUM		0.683	1.09	0.923							
CALCIUM		2500	4430	1810							
CHROMIUM		24.6	66.6	25							
COBALT		21.9	14.3	13.5							
COPPER		20.5	21.7	33.8							
IRON		40200	90700	37600							
LEAD		22.8	140	125							
MAGNESIUM		2340	923	999							
MANGANESE		694	974	749							
NICKEL		28.7	50.2	16.8							
POTASSIUM		1790	626	1040							
SELENIUM		0.65	0.559	0.46							
SILVER		0.102	0.117	0.113							
SODIUM		75.7 U	22.7 U	21.1 U							
THALLIUM		0.25	0.0808	0.138							
VANADIUM		29.6	46.3	23.7							
ZINC		59.3	110	111							
XRF Lead (mg/kg)											
LEAD	49.5	61	101.67	254	74.33	0 U	38	0 U	42.33	47	83.33

order	012	013	014	015	016	017	018	019	020	021	022
nsample	X7SS0100002	X7SS0110002	X7SS0120002	X7SS0120002-AVG	X7SS0120002-D	X7SS0130002	X7SS0140002	X7SS0150002	X7SS0160002	X7SS0170002	X7SS0180002
location	X7-SB010	X7-SB011	X7-SB012	X7-SB012	X7-SB012	X7-SB012	X7-SB014	X7-SB015	X7-SB016	X7-SB017	X7-SB018
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0100002	X7SS0110002	X7SS0120002	X7SS0120002-AVG	X7FD10020701	X7SS0130002	X7SS0140002	X7SS0150002	X7SS0160002	X7SS0170002	X7SS0180002
sample_dat	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate					X7SS0120002						
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_012	c_013	c_014	c_015	c_016	c_017	c_018	c_019	c_020	c_021	c_022
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM			14000	15250	16500						
ANTIMONY			1.6 J	1.015 J	0.86 U						
ARSENIC			7.93	8.01	8.09						
BARIUM			95.6	99.3	103						
BERYLLIUM			0.909	0.8645	0.82						
CADMIUM			0.959	0.824	0.689						
CALCIUM			13400	12300	11200						
CHROMIUM			22.3	21.7	21.1						
COBALT			11.4	12.05	12.7						
COPPER			30.9	26.6	22.3						
IRON			37200	30200	23200						
LEAD			43.9	35.25	26.6						
MAGNESIUM			2130	2240	2350						
MANGANESE			1370	1290	1210						
NICKEL			17.8	17.65	17.5						
POTASSIUM			1190	1145	1100						
SELENIUM			0.618	0.61	0.602						
SILVER			0.11	0.1065	0.103						
SODIUM			36.8 U	37.7 U	38.6 U						
THALLIUM			0.204	0.215	0.226						
VANADIUM			34.9	35.25	35.6						
ZINC			68.1	63.8	59.5						
XRF Lead (mg/kg)											
LEAD	88.67	0 U	45.67			49.67	61	38	39	49.33	113.67

order	023	024	025	026	027	028	029	030	031	032	033
nsample	X7SS0190002	X7SS0200002	X7SS0210002	X7SS0220002	X7SS0230002	X7SS0240002	X7SS0250002	X7SS0260002	X7SS0270002	X7SS0280002	X7SS0290002
location	X7-SB019	X7-SB020	X7-SB021	X7-SB022	X7-SB023	X7-SB024	X7-SB025	X7-SB026	X7-SB027	X7-SB028	X7-SB029
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0190002	X7SS0200002	X7SS0210002	X7SS0220002	X7SS0230002	X7SS0240002	X7SS0250002	X7SS0260002	X7SS0270002	X7SS0280002	X7SS0290002
sample_dat	20071002	20071002	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate											
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_023	c_024	c_025	c_026	c_027	c_028	c_029	c_030	c_031	c_032	c_033
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM	13300										
ANTIMONY	3.7 J										
ARSENIC	5.69										
BARIUM	118										
BERYLLIUM	0.873										
CADMIUM	0.712										
CALCIUM	4700										
CHROMIUM	21										
COBALT	12.4										
COPPER	427										
IRON	29200										
LEAD	537										
MAGNESIUM	1950										
MANGANESE	950										
NICKEL	24.8										
POTASSIUM	1780										
SELENIUM	0.553										
SILVER	0.105										
SODIUM	57.8 U										
THALLIUM	0.157										
VANADIUM	27.1										
ZINC	148										
XRF Lead (mg/kg)											
LEAD	255.33	33.67	36	0 U	30	30	34	29	0 U	30.5	0 U

order	034	035	036	037	038	039	040	041	042	043	044
nsample	X7SS0300002	X7SS0300002-D	X7SS0310002	X7SS0320002	X7SS0330002	X7SS0340002	X7SS0350002	X7SS0360002	X7SS0370002	X7SS0380002	X7SS0390002
location	X7-SB030	X7-SB030	X7-SB031	X7-SB032	X7-SB033	X7-SB034	X7-SB035	X7-SB036	X7-SB037	X7-SB038	X7-SB039
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0300002	X7SS0300002D	X7SS0310002	X7SS0320002	X7SS0330002	X7SS0340002	X7SS0350002	X7SS0360002	X7SS0370002	X7SS0380002	X7SS0390002
sample_dat	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate		X7SS0300002									
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_034	c_035	c_036	c_037	c_038	c_039	c_040	c_041	c_042	c_043	c_044
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM											15300
ANTIMONY											96.2 J
ARSENIC											7.2
BARIUM											91.2
BERYLLIUM											0.637
CADMIUM											0.895
CALCIUM											26700
CHROMIUM											20.4
COBALT											9.72
COPPER											94.6
IRON											26600
LEAD											495
MAGNESIUM											7000
MANGANESE											737
NICKEL											14.5
POTASSIUM											1100
SELENIUM											0.406
SILVER											0.109
SODIUM											65.3 U
THALLIUM											0.197
VANADIUM											32.1
ZINC											89.8
XRF Lead (mg/kg)											
LEAD	48.67	29	37	33.67	32	0 U	0 U	0 U	43.33	213.33	382

order	045	046	047	048	049	050	051	052	053	054	055
nsample	X7SS0400002	X7SS0410002	X7SS0420002	X7SS0430002	X7SS0440002	X7SS0450002	X7SS0450002-AVG	X7SS0450002-D	X7SS0460002	X7SS0470002	X7SS0480002
location	X7-SB040	X7-SB041	X7-SB042	X7-SB043	X7-SB044	X7-SB045	X7-SB045	X7-SB045	X7-SB046	X7-SB047	X7-SB048
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0400002	X7SS0410002	X7SS0420002	X7SS0430002	X7SS0440002	X7SS0450002	X7SS0450002-AVG	X7FD10030701	X7SS0460002	X7SS0470002	X7SS0480002
sample_dat	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate								X7SS0450002			
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_045	c_046	c_047	c_048	c_049	c_050	c_051	c_052	c_053	c_054	c_055
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM					14900	13400	13100	12800	16300		15700
ANTIMONY					4.5 J	3.9 J	6.65 J	9.4 J	24.5 J		5.6 J
ARSENIC					6.34	7.72	9.01	10.3	7.38		7.5
BARIUM					61	69.4	65.9	62.4	85.3		80.9
BERYLLIUM					0.553	0.601	0.8905	1.18	0.776		0.612
CADMIUM					0.462	0.387	0.668	0.949	0.594		1.05
CALCIUM					735	917	852.5	788	3670		1300
CHROMIUM					24.1	27.4	33.55	39.7	23.4		23.2
COBALT					12.1	13.7	12.55	11.4	12		12.5
COPPER					96.1	128	132	136	283		93.5
IRON					32100	38600	39250	39900	22900		26600
LEAD					199	286	344.5	403	1100		190
MAGNESIUM					1680	1610	1395	1180	2760		1720
MANGANESE					709	919	733	547	1060		461
NICKEL					11.7	14	17.05	20.1	15.7		13.7
POTASSIUM					852	788	779.5	771	1100		894
SELENIUM					0.249	0.273	0.331	0.389	0.368		0.365
SILVER					0.064	0.0695	0.0953	0.121	0.115		0.1
SODIUM					59.2 U	16.1 U	24.45 U	32.8 U	34.1 U		44.4 U
THALLIUM					0.17	0.181	0.173	0.165	0.223		0.197
VANADIUM					32.5	34.7	40.2	45.7	35.9		36.9
ZINC					50.3	52.3	57.7	63.1	79.4		54.1
XRF Lead (mg/kg)											
LEAD	124	30.67	0 U	62	204	562			701	69.33	146.33

order	056	057	058	059	060	061	062	063	064	065	066
nsample	X7SS0490002	X7SS0500002	X7SS0510002	X7SS0520002	X7SS0530002	X7SS0540002	X7SS0550002	X7SS0550002-D	X7SS0560002	X7SS0570002	X7SS0580002
location	X7-SB049	X7-SB050	X7-SB051	X7-SB052	X7-SB053	X7-SB054	X7-SB055	X7-SB055	X7-SB056	X7-SB057	X7-SB058
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0490002	X7SS0500002	X7SS0510002	X7SS0520002	X7SS0530002	X7SS0540002	X7SS0550002	X7SS0550002D(3)	X7SS0560002	X7SS0570002	X7SS0580002
sample_dat	20071003	20071003	20071003	20071003	20071004	20071004	20071006	20071004	20071004	20071004	20071006
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate								X7SS0550002			
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_056	c_057	c_058	c_059	c_060	c_061	c_062	c_063	c_064	c_065	c_066
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM							11400				
ANTIMONY							37.9 J				
ARSENIC							10.8				
BARIUM							86.1				
BERYLLIUM							0.715				
CADMIUM							1.27				
CALCIUM							1080				
CHROMIUM							18.6				
COBALT							14.9				
COPPER							197				
IRON							26700				
LEAD							1160				
MAGNESIUM							1040				
MANGANESE							1110				
NICKEL							18.6				
POTASSIUM							579				
SELENIUM							0.663				
SILVER							0.161				
SODIUM							40.5 U				
THALLIUM							0.171				
VANADIUM							32				
ZINC							77.9				
XRF Lead (mg/kg)											
LEAD	28	62.67	35	39	37	31	741	1014.67	0 U	0 U	105

order	067	068	069	070	071	072	073	074	075	076	077
nsample	X7SS0580002-D	X7SS0590002	X7SS0600002	X7SS0610002	X7SS0620002	X7SS0630002	X7SS0640002	X7SS0650002	X7SS0660002	X7SS0670002	X7SS0680002
location	X7-SB058	X7-SB059	X7-SB060	X7-SB061	X7-SB062	X7-SB063	X7-SB064	X7-SB065	X7-SB066	X7-SB067	X7-SB068
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0580002D(4)	X7SS0590002	X7SS0600002	X7SS0610002	X7SS0620002	X7SS0630002	X7SS0640002	X7SS0650002	X7SS0660002	X7SS0670002	X7SS0680002
sample_dat	20071004	20071004	20071004	20071004	20071004	20071004	20071004	20071004	20071004	20071004	20071004
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate	X7SS0580002										
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_067	c_068	c_069	c_070	c_071	c_072	c_073	c_074	c_075	c_076	c_077
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM									8700		
ANTIMONY									0.21 J		
ARSENIC									3.86		
BARIUM									163		
BERYLLIUM									0.407		
CADMIUM									0.662		
CALCIUM									763		
CHROMIUM									10.2		
COBALT									6.79		
COPPER									6.34		
IRON									12200		
LEAD									10.3		
MAGNESIUM									830		
MANGANESE									347		
NICKEL									8.75		
POTASSIUM									476		
SELENIUM									0.546		
SILVER									0.0627		
SODIUM									46.8		
THALLIUM									0.138		
VANADIUM									19.9		
ZINC									30.9		
XRF Lead (mg/kg)											
LEAD	85	29	0 U	0 U	27	0 U	0 U	33	28.5	0 U	0 U

Pos

14P

order	078	079	080	081	082	083	084	085	086	087	088
nsample	X7SS0690002	X7SS0700002	X7SS0710002	X7SS0710002-D	X7SS0720002	X7SS0730002	X7SS0740002	X7SS0750002	X7SS0760002	X7SS0770002	X7SS0780002
location	X7-SB069	X7-SB070	X7-SB071	X7-SB071	X7-SB072	X7-SB073	X7-SB074	X7-SB075	X7-SB076	X7-SB077	X7-SB078
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0690002	X7SS0700002	X7SS0710002	X7SS0710002D	X7SS0720002	X7SS0730002	X7SS0740002	X7SS0750002	X7SS0760002	X7SS0770002	X7SS0780002
sample_dat	20071005	20071009	20071005	20071005	20071004	20071005	20071005	20071005	20071005	20071005	20071005
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate				X7SS0710002							
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_078	c_079	c_080	c_081	c_082	c_083	c_084	c_085	c_086	c_087	c_088
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE			1.6 U					1.8 U			
ACENAPHTHENE			1.2 U					4.9 J			
ACENAPHTHYLENE			0.64 U					0.71 U			
ANTHRACENE			0.85 U					7.2			
BENZO(A)ANTHRACENE			12					140			
BENZO(A)PYRENE			17					170			
BENZO(B)FLUORANTHENE			20					230			
BENZO(G,H,I)PERYLENE			7.1					48			
BENZO(K)FLUORANTHENE			8					92			
CHRYSENE			13					160			
DIBENZO(A,H)ANTHRACENE			1.1 U					18			
FLUORANTHENE			15					180			
FLUORENE			0.65 U					4.6 J			
INDENO(1,2,3-CD)PYRENE			4.8 J					60			
NAPHTHALENE			1.2 U					1.3 U			
PHENANTHRENE			1.1 U					30			
PYRENE			17					200			
Inorganics (mg/kg)											
ALUMINUM								14800			
ANTIMONY								0.93 J			
ARSENIC								8.54			
BARIUM								627			
BERYLLIUM								0.634			
CADMIUM								1.12			
CALCIUM								1930			
CHROMIUM								16.5			
COBALT								10.3			
COPPER								15			
IRON								23000			
LEAD								33.1			
MAGNESIUM								1410			
MANGANESE								770			
NICKEL								14.8			
POTASSIUM								853			
SELENIUM								0.575			
SILVER								0.0844			
SODIUM								66.7			
THALLIUM								0.209			
VANADIUM								32.8			
ZINC								63			
XRF Lead (mg/kg)											
LEAD	0 U	22	0 U	0 U	29	41	38	29.67	0 U	0 U	28

order	089	090	091	092	093	094	095	096	097	098	099
nsample	X7SS0790002	X7SS0790002-AVG	X7SS0790002-D	X7SS0800002	X7SS0810002	X7SS0820002	X7SS0820002-D	X7SS0830002	X7SS0840002	X7SS0850002	X7SS0860002
location	X7-SB079	X7-SB079	X7-SB079	X7-SB080	X7-SB081	X7-SB082	X7-SB082	X7-SB083	X7-SB084	X7-SB085	X7-SB086
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0790002	X7SS0790002-AVG	X7FD10050701	X7SS0800002	X7SS0810002	X7SS0820002	X7SS0820002D	X7SS0830002	X7SS0840002	X7SS0850002	X7SS0860002
sample_dat	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate			X7SS0790002				X7SS0820002				
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_089**	**c_090**	**c_091**	**c_092**	**c_093**	**c_094**	**c_095**	**c_096**	**c_097**	**c_098**	**c_099**
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE	1.6 U	1.6 U	1.6 U		1.6 U						1.7 U
ACENAPHTHENE	1.1 U	1.15 U	1.2 U		1.1 U						1.2 U
ACENAPHTHYLENE	0.63 U	0.635 U	0.64 U		0.64 U						0.68 U
ANTHRACENE	0.83 U	0.84 U	0.85 U		0.84 U						0.9 U
BENZO(A)ANTHRACENE	0.87 U	0.88 U	0.89 U		0.88 U						0.95 UJ
BENZO(A)PYRENE	0.96 U	0.97 U	0.98 U		0.97 U						1 UJ
BENZO(B)FLUORANTHENE	0.87 U	0.88 U	0.89 U		0.88 U						0.95 UJ
BENZO(G,H,I)PERYLENE	0.96 U	0.97 U	0.98 U		0.97 U						1 UJ
BENZO(K)FLUORANTHENE	0.45 U	0.455 U	0.46 U		0.46 U						0.49 UJ
CHRYSENE	0.83 U	0.84 U	0.85 U		0.84 U						0.9 UJ
DIBENZO(A,H)ANTHRACENE	1 U	1.05 U	1.1 U		1.1 U						1.1 UJ
FLUORANTHENE	0.83 U	0.84 U	0.85 U		0.84 U						0.9 U
FLUORENE	0.64 U	0.645 U	0.65 U		0.64 U						0.69 U
INDENO(1,2,3-CD)PYRENE	1.2 U	1.25 U	1.3 U		1.2 U						1.3 UJ
NAPHTHALENE	1.1 U	1.15 U	1.2 U		1.1 U						1.2 U
PHENANTHRENE	1 U	1.05 U	1.1 U		1.1 U						1.1 U
PYRENE	1 U	1.05 U	1.1 U		1.1 U						1.1 UJ
Inorganics (mg/kg)											
ALUMINUM											
ANTIMONY											
ARSENIC											
BARIUM											
BERYLLIUM											
CADMIUM											
CALCIUM											
CHROMIUM											
COBALT											
COPPER											
IRON											
LEAD											
MAGNESIUM											
MANGANESE											
NICKEL											
POTASSIUM											
SELENIUM											
SILVER											
SODIUM											
THALLIUM											
VANADIUM											
ZINC											
XRF Lead (mg/kg)											
LEAD	0 U			41	34	32	31	0 U	0 U	41	0 U

order	100	101	102	103	104	105	106	107	108	109	110
nsample	X7SS0870002	X7SS0880002	X7SS0890002	X7SS0900002	X7SS0910002	X7SS0920002	X7SS0930002	X7SS0940002	X7SS0950002	X7SS0960002	X7SS0970002
location	X7-SB087	X7-SB088	X7-SB089	X7-SB090	X7-SB091	X7-SB092	X7-SB093	X7-SB094	X7-SB095	X7-SB096	X7-SB097
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0870002	X7SS0880002	X7SS0890002	X7SS0900002	X7SS0910002	X7SS0920002	X7SS0930002	X7SS0940002	X7SS0950002	X7SS0960002	X7SS0970002
sample_dat	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071006	20071006	20071007
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate											
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_100**	**c_101**	**c_102**	**c_103**	**c_104**	**c_105**	**c_106**	**c_107**	**c_108**	**c_109**	**c_110**
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM											
ANTIMONY											
ARSENIC											
BARIUM											
BERYLLIUM											
CADMIUM											
CALCIUM											
CHROMIUM											
COBALT											
COPPER											
IRON											
LEAD											
MAGNESIUM											
MANGANESE											
NICKEL											
POTASSIUM											
SELENIUM											
SILVER											
SODIUM											
THALLIUM											
VANADIUM											
ZINC											
XRF Lead (mg/kg)											
LEAD	0 U	29	29	40	0 U	26	0 U	0 U	50	0 U	0 U

order	111	112	113	114	115	116	117	118	119	120	121
nsample	X7SS0980002	X7SS0990002	X7SS1000002	X7SS1010002	X7SS1020002	X7SS1030002	X7SS1040002	X7SS1050002	X7SS1060002	X7SS1070002	X7SS1080002
location	X7-SB098	X7-SB099	X7-SB100	X7-SB101	X7-SB102	X7-SB103	X7-SB104	X7-SB105	X7-SB106	X7-SB107	X7-SB108
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0980002	X7SS0990002	X7SS1000002	X7SS1010002	X7SS1020002	X7SS1030002	X7SS1040002	X7SS1050002	X7SS1060002	X7SS1070002	X7SS1080002
sample_dat	20071007	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071009	20071009
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate											
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_111	c_112	c_113	c_114	c_115	c_116	c_117	c_118	c_119	c_120	c_121
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM											
ANTIMONY											
ARSENIC											
BARIUM											
BERYLLIUM											
CADMIUM											
CALCIUM											
CHROMIUM											
COBALT											
COPPER											
IRON											
LEAD											
MAGNESIUM											
MANGANESE											
NICKEL											
POTASSIUM											
SELENIUM											
SILVER											
SODIUM											
THALLIUM											
VANADIUM											
ZINC											
XRF Lead (mg/kg)											
LEAD	0 U	37.33	0 U	37	45.5	27	29	31	0 U	28	25.67

15

order	122	123	124	125	126	127	128	129	130	131	132
nsample	X7SS1090002	X7SS1100002	X7SS1110002	X7SS1120002	X7SS1120002-D	X7SS1130002	X7SS1140002	X7SS1150002	X7SS1160002	X7SS1170002	X7SS1180002
location	X7-SB109	X7-SB110	X7-SB111	X7-SB112	X7-SB112	X7-SB113	X7-SB114	X7-SB115	X7-SB116	X7-SB117	X7-SB118
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1090002	X7SS1100002	X7SS1110002	X7SS1120002	X7SS1120002D	X7SS1130002	X7SS1140002	X7SS1150002	X7SS1160002	X7SS1170002	X7SS1180002
sample_dat	20071009	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate					X7SS1120002						
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_122	c_123	c_124	c_125	c_126	c_127	c_128	c_129	c_130	c_131	c_132
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE									3.9 J		
ACENAPHTHENE									30		
ACENAPHTHYLENE									0.64 U		
ANTHRACENE									64		
BENZO(A)ANTHRACENE									640		
BENZO(A)PYRENE									890 J		
BENZO(B)FLUORANTHENE									1400 J		
BENZO(G,H,I)PERYLENE									340 J		
BENZO(K)FLUORANTHENE									490 J		
CHRYSENE									730		
DIBENZO(A,H)ANTHRACENE									69 J		
FLUORANTHENE									780		
FLUORENE									16		
INDENO(1,2,3-CD)PYRENE									330 J		
NAPHTHALENE									1.2 U		
PHENANTHRENE									280		
PYRENE									1200		
Inorganics (mg/kg)											
ALUMINUM											
ANTIMONY											
ARSENIC											
BARIUM											
BERYLLIUM											
CADMIUM											
CALCIUM											
CHROMIUM											
COBALT											
COPPER											
IRON											
LEAD											
MAGNESIUM											
MANGANESE											
NICKEL											
POTASSIUM											
SELENIUM											
SILVER											
SODIUM											
THALLIUM											
VANADIUM											
ZINC											
XRF Lead (mg/kg)											
LEAD	25.67	41	36	35	29	31	0 U	31	0 U	30.67	31.33

14

order	133	134	135	136	137	138	139	140	141	142	143
nsample	X7SS1190002	X7SS1200002	X7SS1210002	X7SS1220002	X7SS1230002	X7SS1240002	X7SS1250002	X7SS1260002	X7SS1270002	X7SS1270002-D	X7SS1280002
location	X7-SB119	X7-SB120	X7-SB121	X7-SB122	X7-SB123	X7-SB124	X7-SB125	X7-SB126	X7-SB127	X7-SB127	X7-SB128
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1190002	X7SS1200002	X7SS1210002	X7SS1220002	X7SS1230002	X7SS1240002	X7SS1250002	X7SS1260002	X7SS1270002	X7SS1270002D	X7SS1280002
sample_dat	20071007	20071006	20071006	20071006	20071006	20071006	20071006	20071007	20071007	20071007	20071006
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate										X7SS1270002	
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_133	c_134	c_135	c_136	c_137	c_138	c_139	c_140	c_141	c_142	c_143
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE			40	1.8 U	7						
ACENAPHTHENE			550 J	1.3 U	95						
ACENAPHTHYLENE			0.75 U	0.73 U	27						
ANTHRACENE			970	0.96 U	170						
BENZO(A)ANTHRACENE			6400	10	1200						
BENZO(A)PYRENE			8100 J	14	1600 J						
BENZO(B)FLUORANTHENE			12000 J	20	2700 J						
BENZO(G,H,I)PERYLENE			2900 J	5.7 J	730 J						
BENZO(K)FLUORANTHENE			4700 J	6.4 J	880 J						
CHRYSENE			7400	13	1500						
DIBENZO(A,H)ANTHRACENE			970 J	1.2 U	150 J						
FLUORANTHENE			8700	14	1300						
FLUORENE			270	0.74 U	42						
INDENO(1,2,3-CD)PYRENE			2900 J	4.7 J	670 J						
NAPHTHALENE			1.4 U	1.3 U	1 U						
PHENANTHRENE			4900	1.2 U	680						
PYRENE			14000	15	2700						
Inorganics (mg/kg)											
ALUMINUM									19400		
ANTIMONY									0.61 J		
ARSENIC									8.84		
BARIUM									145		
BERYLLIUM									0.883		
CADMIUM									1.43		
CALCIUM									3720		
CHROMIUM									23.9		
COBALT									14.4		
COPPER									24.7		
IRON									26000		
LEAD									25.3		
MAGNESIUM									2510		
MANGANESE									677		
NICKEL									17.1		
POTASSIUM									1750		
SELENIUM									0.405		
SILVER									0.129		
SODIUM									62.2 U		
THALLIUM									0.231		
VANADIUM									38.1		
ZINC									64.4		
XRF Lead (mg/kg)											
LEAD	37	27	30.67	38	37.5	41.33	32	44.33	35	32	33.5

order	144	145	146	147	148	149	150	151	152	153	154
nsample	X7SS1290002	X7SS1300002	X7SS1310002	X7SS1320002	X7SS1330002	X7SS1340002	X7SS1350002	X7SS1360002	X7SS1370002	X7SS1380002	X7SS1390002
location	X7-SB129	X7-SB130	X7-SB131	X7-SB132	X7-SB133	X7-SB134	X7-SB135	X7-SB136	X7-SB137	X7-SB138	X7-SB139
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1290002	X7SS1300002	X7SS1310002	X7SS1320002	X7SS1330002	X7SS1340002	X7SS1350002	X7SS1360002	X7SS1370002	X7SS1380002	X7SS1390002
sample_dat	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate											
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_144	c_145	c_146	c_147	c_148	c_149	c_150	c_151	c_152	c_153	c_154
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE	1.6 U							1.7 U			
ACENAPHTHENE	1.2 U							1.2 U			
ACENAPHTHYLENE	0.65 U							0.68 U			
ANTHRACENE	4.2 J							0.9 U			
BENZO(A)ANTHRACENE	55							0.95 U			
BENZO(A)PYRENE	88							1 U			
BENZO(B)FLUORANTHENE	130							0.95 U			
BENZO(G,H,I)PERYLENE	36							1 U			
BENZO(K)FLUORANTHENE	48							0.49 U			
CHRYSENE	76							0.9 U			
DIBENZO(A,H)ANTHRACENE	1.1 U							1.1 U			
FLUORANTHENE	76							0.9 U			
FLUORENE	0.66 U							0.69 U			
INDENO(1,2,3-CD)PYRENE	39							1.3 U			
NAPHTHALENE	1.2 U							1.2 U			
PHENANTHRENE	21							1.1 U			
PYRENE	86							3.2 J			
Inorganics (mg/kg)											
ALUMINUM											
ANTIMONY											
ARSENIC											
BARIUM											
BERYLLIUM											
CADMIUM											
CALCIUM											
CHROMIUM											
COBALT											
COPPER											
IRON											
LEAD											
MAGNESIUM											
MANGANESE											
NICKEL											
POTASSIUM											
SELENIUM											
SILVER											
SODIUM											
THALLIUM											
VANADIUM											
ZINC											
XRF Lead (mg/kg)											
LEAD	46	37	43.33	37.33	31	34	43.67	30.67	29	31	44.67

order	155	156	157	158	159	160	161	162	163	164	165
nsample	X7SS1400002	X7SS1410002	X7SS1420002	X7SS1430002	X7SS1430002-D	X7SS1440002	X7SS1440002-D	X7SS1450002	X7SS1460002	X7SS1470002	X7SS1480002
location	X7-SB140	X7-SB141	X7-SB142	X7-SB143	X7-SB143	X7-SB144	X7-SB144	X7-SB145	X7-SB146	X7-SB147	X7-SB148
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1400002	X7SS1410002	X7SS1420002	X7SS1430002	X7SS1430002D	X7SS1440002	X7SS1440002D	X7SS1450002	X7SS1460002	X7SS1470002	X7SS1480002
sample_dat	20071006	20071006	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate					X7SS1430002		X7SS1440002				
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_155	c_156	c_157	c_158	c_159	c_160	c_161	c_162	c_163	c_164	c_165
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM											13700
ANTIMONY											1.2 J
ARSENIC											7.41
BARIUM											153
BERYLLIUM											0.859
CADMIUM											1.32
CALCIUM											5560
CHROMIUM											18.7
COBALT											15.3
COPPER											26.6
IRON											22400
LEAD											71.8
MAGNESIUM											2100
MANGANESE											1320
NICKEL											21.4
POTASSIUM											1730
SELENIUM											0.661
SILVER											0.0984
SODIUM											106 U
THALLIUM											0.18
VANADIUM											28.1
ZINC											58.5
XRF Lead (mg/kg)											
LEAD	40.5	31	30.67	41.67	36.67	0 U	33	61.67	39.33	71	148

order	166	167	168	169	170	171	172	173	174	175	176
nsample	X7SS1490002	X7SS1500002	X7SS1510002	X7SS1520002	X7SS1530002	X7SS1540002	X7SS1550002	X7SS1550002-D	X7SS1560002	X7SS1570002	X7SS1580002
location	X7-SB149	X7-SB150	X7-SB151	X7-SB152	X7-SB153	X7-SB154	X7-SB155	X7-SB155	X7-SB156	X7-SB157	X7-SB158
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1490002	X7SS1500002	X7SS1510002	X7SS1520002	X7SS1530002	X7SS1540002	X7SS1550002	X7SS1550002D	X7SS1560002	X7SS1570002	X7SS1580002
sample_dat	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate								X7SS1550002			
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_166**	**c_167**	**c_168**	**c_169**	**c_170**	**c_171**	**c_172**	**c_173**	**c_174**	**c_175**	**c_176**
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM				12800							
ANTIMONY				6.1 J							
ARSENIC				7.84							
BARIUM				134							
BERYLLIUM				0.888							
CADMIUM				1.25							
CALCIUM				18000							
CHROMIUM				23							
COBALT				17.3							
COPPER				66.3							
IRON				27300							
LEAD				460							
MAGNESIUM				5840							
MANGANESE				1280							
NICKEL				26.6							
POTASSIUM				1550							
SELENIUM				0.717							
SILVER				0.105							
SODIUM				68.9 U							
THALLIUM				0.169							
VANADIUM				31.2							
ZINC				72.9							
XRF Lead (mg/kg)											
LEAD	55.33	30.33	28.67	247.33	71.67	25	25.67	33	27	41.33	27

order	177	178	179	180	181	182	183	184	185	186	187
nsample	X7SS1590002	X7SS1600002	X7SS1610002	X7SS1620002	X7SS1630002	X7SS1640002	X7SS1650002	X7SS1660002	X7SS1670002	X7SS1680002	X7SS1690002
location	X7-SB159	X7-SB160	X7-SB161	X7-SB162	X7-SB163	X7-SB164	X7-SB165	X7-SB166	X7-SB167	X7-SB168	X7-SB169
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1590002	X7SS1600002	X7SS1610002	X7SS1620002	X7SS1630002	X7SS1640002	X7SS1650002	X7SS1660002	X7SS1670002	X7SS1680002	X7SS1690002
sample_dat	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate											
top_depth	0	0	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_177	c_178	c_179	c_180	c_181	c_182	c_183	c_184	c_185	c_186	c_187
Semivolatile Organics (ug/kg)											
2-METHYLNAPHTHALENE											
ACENAPHTHENE											
ACENAPHTHYLENE											
ANTHRACENE											
BENZO(A)ANTHRACENE											
BENZO(A)PYRENE											
BENZO(B)FLUORANTHENE											
BENZO(G,H,I)PERYLENE											
BENZO(K)FLUORANTHENE											
CHRYSENE											
DIBENZO(A,H)ANTHRACENE											
FLUORANTHENE											
FLUORENE											
INDENO(1,2,3-CD)PYRENE											
NAPHTHALENE											
PHENANTHRENE											
PYRENE											
Inorganics (mg/kg)											
ALUMINUM									18400		
ANTIMONY									0.73 J		
ARSENIC									10.6		
BARIUM									138		
BERYLLIUM									1.13		
CADMIUM									1.79		
CALCIUM									3100		
CHROMIUM									28.6		
COBALT									17.8		
COPPER									36.9		
IRON									36100		
LEAD									72.2		
MAGNESIUM									1860		
MANGANESE									934		
NICKEL									28.9		
POTASSIUM									2380		
SELENIUM									0.81		
SILVER									0.144		
SODIUM									75.8 U		
THALLIUM									0.205		
VANADIUM									37.4		
ZINC									86.4		
XRF Lead (mg/kg)											
LEAD	24.5	30.67	73	194.33	71.67	133.33	128.67	50.67	101	41.67	18

order	188	189	190	191	192	193
nsample	X7SS1700002	X7SS1710002	X7SS1730002	X7SS1740002	X7SS1750002	X7SS1760002
location	X7-SB170	X7-SB171	X7-SB173	X7-SB174	X7-SB175	X7-SB176
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1700002	X7SS1710002	X7SS1730002	X7SS1740002	X7SS1750002	X7SS1760002
sample_dat	20071007	20071007	20071007	20071007	20071007	20071007
matrix	SO	SO	SO	SO	SO	SO
duplicate						
top_depth	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT
sort	c_188	c_189	c_190	c_191	c_192	c_193
Semivolatile Organics (ug/kg)						
2-METHYLNAPHTHALENE						
ACENAPHTHENE						
ACENAPHTHYLENE						
ANTHRACENE						
BENZO(A)ANTHRACENE						
BENZO(A)PYRENE						
BENZO(B)FLUORANTHENE						
BENZO(G,H,I)PERYLENE						
BENZO(K)FLUORANTHENE						
CHRYSENE						
DIBENZO(A,H)ANTHRACENE						
FLUORANTHENE						
FLUORENE						
INDENO(1,2,3-CD)PYRENE						
NAPHTHALENE						
PHENANTHRENE						
PYRENE						
Inorganics (mg/kg)						
ALUMINUM			10900	10600	9300	
ANTIMONY			3.7 J	12.3 J	3.3 J	
ARSENIC			11.5	8.8	15.2	
BARIUM			91.4	87.9	90.6	
BERYLLIUM			0.95	0.741	0.905	
CADMIUM			1.26	1.34	2.21	
CALCIUM			1350	1420	1430	
CHROMIUM			20.7	19.1	18.1	
COBALT			12.9	14.3	17.6	
COPPER			30.8	98.7	59.7	
IRON			44000	20900	51900	
LEAD			125	430	170	
MAGNESIUM			1160	1040	723	
MANGANESE			1060	912	1310	
NICKEL			22.6	19.1	25.9	
POTASSIUM			754	782	768	
SELENIUM			0.631	0.546	0.743	
SILVER			0.136	0.165	0.141	
SODIUM			83.9 U	58.5 U	31.1 U	
THALLIUM			0.162	0.158	0.141	
VANADIUM			38.9	27.2	31	
ZINC			61	64	118	
XRF Lead (mg/kg)						
LEAD	237.67	24.33	121.33	442.33	96	147.33

order	194	195	196	197	198
nsample	X7SS1770002	X7SS1780002	X7SS1790002	X7SS1800002	X7SS1810002
location	X7-SB177	X7-SB178	X7-SB179	X7-SB180	X7-SB181
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1770002	X7SS1780002	X7SS1790002	X7SS1800002	X7SS1810002
sample_dat	20071007	20071007	20071007	20071007	20071007
matrix	SO	SO	SO	SO	SO
duplicate					
top_depth	0	0	0	0	0
bottom_dep	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT
sort	c_194	c_195	c_196	c_197	c_198
Semivolatile Organics (ug/kg)					
2-METHYLNAPHTHALENE					
ACENAPHTHENE					
ACENAPHTHYLENE					
ANTHRACENE					
BENZO(A)ANTHRACENE					
BENZO(A)PYRENE					
BENZO(B)FLUORANTHENE					
BENZO(G,H,I)PERYLENE					
BENZO(K)FLUORANTHENE					
CHRYSENE					
DIBENZO(A,H)ANTHRACENE					
FLUORANTHENE					
FLUORENE					
INDENO(1,2,3-CD)PYRENE					
NAPHTHALENE					
PHENANTHRENE					
PYRENE					
Inorganics (mg/kg)					
ALUMINUM	15200	15500	11500	16200	14800
ANTIMONY	2.6 J	0.98 J	2.0 J	2.1 J	5.3 J
ARSENIC	10.8	8.86	11	15	8.77
BARIUM	59.9	82.8	56.2	81.8	118
BERYLLIUM	0.78	0.594	0.769	0.827 J	1.2
CADMIUM	0.993	0.969	0.439	1.32	0.572
CALCIUM	1330	1360	1110	1020	1080
CHROMIUM	57	30.1	39.2	32.2	45.9
COBALT	15	20.8	14.4	19.2	11.2
COPPER	48.1	16.9	29.2	51.9	63.8
IRON	45000	30600	38400	31500	35800
LEAD	115	40.9	83.6	89	212
MAGNESIUM	1580	1420	1190	2280	1810
MANGANESE	502	821	637	544	571
NICKEL	17.3	16.3	13.6	27	32.4
POTASSIUM	882	884	592	1210	715
SELENIUM	0.365	0.43	0.322	0.604	0.279
SILVER	0.0996	0.0894	0.0593	0.186	0.062
SODIUM	50.1 U	43.9 U	23.8 U	138	19.1 U
THALLIUM	0.175	0.18	0.147	0.39	0.133
VANADIUM	44.1	39.8	35.9	78	73.2
ZINC	53.1	40.7	42.2	74.8	96.5
XRF Lead (mg/kg)					
LEAD	114.67	29.67	104	84.67	202.33

order	199	200	201	202	203	204	205	206	207
nsample	X7SS1820002	X7SS1830002	X7SS1840002	X7SS1850002	X7SS1860002	X7SS1870002	X7SS1880002	X7SS1890002	X7SS1900002
location	X7-SB182	X7-SB183	X7-SB184	X7-SB185	X7-SB186	X7-SB187	X7-SB188	X7-SB189	X7-SB190
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1820002	X7SS1830002	X7SS1840002	X7SS1850002	X7SS1860002	X7SS1870002	X7SS1880002	X7SS1890002	X7SS1900002
sample_dat	20071007	20071007	20071007	20071009	20071009	20071009	20071009	20071009	20071009
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
duplicate									
top_depth	0	0	0	0	0	0	0	0	0
bottom_dep	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	c_199	c_200	c_201	c_202	c_203	c_204	c_205	c_206	c_207
Semivolatile Organics (ug/kg)									
2-METHYLNAPHTHALENE									
ACENAPHTHENE									
ACENAPHTHYLENE									
ANTHRACENE									
BENZO(A)ANTHRACENE									
BENZO(A)PYRENE									
BENZO(B)FLUORANTHENE									
BENZO(G,H,I)PERYLENE									
BENZO(K)FLUORANTHENE									
CHRYSENE									
DIBENZO(A,H)ANTHRACENE									
FLUORANTHENE									
FLUORENE									
INDENO(1,2,3-CD)PYRENE									
NAPHTHALENE									
PHENANTHRENE									
PYRENE									
Inorganics (mg/kg)									
ALUMINUM	11700	19400	15600					10000	
ANTIMONY	2.8 J	0.59 U	0.38 U					2.6 J	
ARSENIC	15.1	17	12.5					5.52	
BARIUM	61.5	92.9	73.7					82.8	
BERYLLIUM	0.703 J	0.718 J	0.625 J					0.86	
CADMIUM	0.823	1.9	1.32					0.815	
CALCIUM	1040	18700	1790					1130	
CHROMIUM	35.2	28.5	21.1					16.7	
COBALT	22.8	16.9	18.6					13.3	
COPPER	44.2	48.2	33.8					46.3	
IRON	45700	29700	24700					23200	
LEAD	95.1	28.8	25.3					151	
MAGNESIUM	1140	3910	2620					1020	
MANGANESE	641	334	477					665	
NICKEL	22.1	29.7	24.3					19.6	
POTASSIUM	810	1740	1180					660	
SELENIUM	0.373	0.913	0.367					0.383	
SILVER	0.0985	0.238	0.152					0.126	
SODIUM	40.9	138	93.5					64.7 U	
THALLIUM	0.224	0.525	0.394					0.128 U	
VANADIUM	57	85.9	64.3					25.6	
ZINC	47	74.3	61					61.8	
XRF Lead (mg/kg)									
LEAD	109	24.67	25.67	24.33	32	21	23.67	165.67	334.67

LOCATION	X7-SB071	X7-SB075	X7-SB079	X7-SB079	X7-SB079	X7-SB081	X7-SB086	X7-SB116	X7-SB121	X7-SB122	X7-SB123	X7-SB129
NSAMPLE	X7SS0710002	X7SS0750002	X7SS0790002	X7SS0790002-AVG	X7SS0790002-D	X7SS0810002	X7SS0860002	X7SS1160002	X7SS1210002	X7SS1220002	X7SS1230002	X7SS1290002
SAMPLE	X7SS0710002	X7SS0750002	X7SS0790002	X7SS0790002-AVG	X7FD10050701	X7SS0810002	X7SS0860002	X7SS1160002	X7SS1210002	X7SS1220002	X7SS1230002	X7SS1290002
MATRIX	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS
TOP DEPTH	0	0	0	0	0	0	0	0	0	0	0	0
BOTTOM DEPTH	2	2	2	2	2	2	2	2	2	2	2	2
SAMPLE DATE	10/5/2007	10/5/2007	10/5/2007	10/5/2007	10/5/2007	10/5/2007	10/5/2007	10/6/2007	10/6/2007	10/6/2007	10/6/2007	10/6/2007
Semivolatile Organics (ug/kg)												
2-METHYLNAPHTHALENE	1.6 U	1.8 U	1.6 U	1.6 U	1.6 U	1.6 U	1.7 U	**3.9 J**	**40**	1.8 U	**7.0**	1.6 U
ACENAPHTHENE	1.2 U	**4.9 J**	1.1 U	1.15 U	1.2 U	1.1 U	1.2 U	**30**	**550 J**	1.3 U	**95**	1.2 U
ACENAPHTHYLENE	0.64 U	0.71 U	0.63 U	0.635 U	0.64 U	0.64 U	0.68 U	0.64 U	0.75 U	0.73 U	**27**	0.65 U
ANTHRACENE	0.85 U	**7.2**	0.83 U	0.84 U	0.85 U	0.84 U	0.90 U	**64**	**970**	0.96 U	**170**	**4.2 J**
BENZO(A)ANTHRACENE	**12**	**140**	0.87 U	0.88 U	0.89 U	0.88 U	0.95 UJ	**640**	**6400**	**10**	**1200**	**55**
BENZO(A)PYRENE	**17**	**170**	0.96 U	0.97 U	0.98 U	0.97 U	1.0 UJ	**890 J**	**8100 J**	**14**	**1600 J**	**88**
BENZO(B)FLUORANTHENE	**20**	**230**	0.87 U	0.88 U	0.89 U	0.88 U	0.95 UJ	**1400 J**	**12000 J**	**20**	**2700 J**	**130**
BENZO(G,H,I)PERYLENE	**7.1**	**48**	0.96 U	0.97 U	0.98 U	0.97 U	1.0 UJ	**340 J**	**2900 J**	**5.7 J**	**730 J**	**36**
BENZO(K)FLUORANTHENE	**8.0**	**92**	0.45 U	0.455 U	0.46 U	0.46 U	0.49 UJ	**490 J**	**4700 J**	**6.4 J**	**880 J**	**48**
CHRYSENE	**13**	**160**	0.83 U	0.84 U	0.85 U	0.84 U	0.90 UJ	**730**	**7400**	**13**	**1500**	**76**
DIBENZO(A,H)ANTHRACENE	1.1 U	**18**	1.0 U	1.05 U	1.1 U	1.1 U	1.1 UJ	**69 J**	**970 J**	1.2 U	**150 J**	1.1 U
FLUORANTHENE	**15**	**180**	0.83 U	0.84 U	0.85 U	0.84 U	0.90 U	**780**	**8700**	**14**	**1300**	**76**
FLUORENE	0.65 U	**4.6 J**	0.64 U	0.645 U	0.65 U	0.64 U	0.69 U	**16**	**270**	0.74 U	**42**	0.66 U
INDENO(1,2,3-CD)PYRENE	**4.8 J**	**60**	1.2 U	1.25 U	1.3 U	1.2 U	1.3 UJ	**330 J**	**2900 J**	**4.7 J**	**670 J**	**39**
PHENANTHRENE	1.1 U	**30**	1.0 U	1.05 U	1.1 U	1.1 U	1.1 U	**280**	**4900**	1.2 U	**680**	**21**
PYRENE	**17**	**200**	1.0 U	1.05 U	1.1 U	1.1 U	1.1 UJ	**1200**	**14000**	**15**	**2700**	**86**

LOCATION	X7-SB136
NSAMPLE	X7SS1360002
SAMPLE	X7SS1360002
MATRIX	SS
TOP DEPTH	0
BOTTOM DEPTH	2
SAMPLE DATE	10/6/2007
Semivolatile Organics (ug/kg)	
2-METHYLNAPHTHALENE	1.7 U
ACENAPHTHENE	1.2 U
ACENAPHTHYLENE	0.68 U
ANTHRACENE	0.90 U
BENZO(A)ANTHRACENE	0.95 U
BENZO(A)PYRENE	1.0 U
BENZO(B)FLUORANTHENE	0.95 U
BENZO(G,H,I)PERYLENE	1.0 U
BENZO(K)FLUORANTHENE	0.49 U
CHRYSENE	0.90 U
DIBENZO(A,H)ANTHRACENE	1.1 U
FLUORANTHENE	0.90 U
FLUORENE	0.69 U
INDENO(1,2,3-CD)PYRENE	1.3 U
PHENANTHRENE	1.1 U
PYRENE	**3.2 J**

APPENDIX E

HUMAN HEALTH RISK SUPPORTING DOCUMENTATION

RAGS-PART D TABLES

TABLE 2.1

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration[1]	Maximum Concentration[1]	Units	Sample with Maximum Concentration	Frequency of Detection	Range of Non-Detects[2]	Concentration Used for Screening[3]	Site above Background ?[4]	U. S. EPA Region 9 PRG (Residential)[5]	Potential ARAR/TBC[6]	Potential ARAR/TBC Source[6]	COPC Flag	Rationale for Contaminant Deletion or Selection[7]
Semivolatile Organic Compounds														
91-57-6	2-methylnaphthalene	3.9 J	40	ug/kg	X7SS1210002	3/11	1.6 - 1.8	40	NA	5600 N[8]	630000	IDEM	No	BSL
83-32-9	Acenaphthene	4.9 J	550 J	ug/kg	X7SS1210002	4/11	1.1 - 1.3	550	NA	370000 N	9500000	IDEM	No	BSL
208-96-8	Acenaphthylene	27	27	ug/kg	X7SS1230002	1/11	0.63 - 0.75	27	NA	370000 N[9]	1100000	IDEM	No	BSL
120-12-7	Anthracene	4.2 J	970	ug/kg	X7SS1210002	5/11	0.83 - 0.96	970	NA	2200000 N	47000000	IDEM	No	BSL
56-55-3	Benzo(a)anthracene	10	6400	ug/kg	X7SS1210002	7/11	0.87 - 0.95	6400	NA	150 C	5000	IDEM	Yes	ASL
50-32-8	Benzo(a)pyrene	14	8100 J	ug/kg	X7SS1210002	7/11	0.96 - 1	8100	NA	15 C	500	IDEM	Yes	ASL
205-99-2	Benzo(b)fluoranthene	20	12000 J	ug/kg	X7SS1210002	7/11	0.87 - 0.95	12000	NA	150 C	5000	IDEM	Yes	ASL
191-24-2	Benzo(g,h,i)perylene	5.7 J	2900 J	ug/kg	X7SS1210002	7/11	0.96 - 1	2900	NA	230000 N[10]	NA	IDEM	No	BSL
207-08-9	Benzo(k)fluoranthene	6.4 J	4700 J	ug/kg	X7SS1210002	7/11	0.45 - 0.49	4700	NA	1500 C	50000	IDEM	Yes	ASL
218-01-9	Chrysene	13	7400	ug/kg	X7SS1210002	7/11	0.83 - 0.9	7400	NA	15000 C	500000	IDEM	No	BSL
53-70-3	Dibenzo(a,h)anthracene	18	970 J	ug/kg	X7SS1210002	4/11	1 - 1.2	970	NA	15 C	500	IDEM	Yes	ASL
206-44-0	Fluoranthene	14	8700	ug/kg	X7SS1210002	7/11	0.83 - 0.9	8700	NA	230000 N	6300000	IDEM	No	BSL
86-73-7	Fluorene	4.6 J	270	ug/kg	X7SS1210002	4/11	0.64 - 0.74	270	NA	270000 N	6300000	IDEM	No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	4.7 J	2900 J	ug/kg	X7SS1210002	7/11	1.2 - 1.3	2900	NA	150 C	5000	IDEM	Yes	ASL
85-01-8	Phenanthrene	21	4900	ug/kg	X7SS1210002	5/11	1 - 1.2	4900	NA	230000 N[10]	470000	IDEM	No	BSL
129-00-0	Pyrene	3.2 J	14000	ug/kg	X7SS1210002	8/11	1 - 1.1	14000	NA	230000 N	4700000	IDEM	No	BSL
Inorganics														
7429-90-5	Aluminum	7910	19400	mg/kg	X7SS1270002,	29/29	---	19400	Yes	7600 N	NA	NA	Yes	ASL
7440-36-0	Antimony	0.21 J	96.2 J	mg/kg	X7SS0390002	26/29	0.38 - 0.71	96.2	Yes	3.1 N	140	IDEM	Yes	ASL
7440-38-2	Arsenic	3.86	17	mg/kg	X7SS1830002	29/29	---	17	Yes	0.39 C	3.9	IDEM	Yes	ASL
7440-39-3	Barium	56.2	949	mg/kg	X7SS0040002	29/29	---	949	No	540 N	63000	IDEM	Yes	ASL
7440-41-7	Beryllium	0.407	1.35	mg/kg	X7SS0030002	29/29	---	1.35	Yes	15 N	680	IDEM	No	BSL
7440-43-9	Cadmium	0.387	2.21	mg/kg	X7SS1750002	29/29	---	2.21	No	3.7 N	12	IDEM	No	BSL
7440-70-2	Calcium	735	26700	mg/kg	X7SS0390002	29/29	---	26700	No	NA	NA	NA	No	NUT
7440-47-3	Chromium	10.2	66.6	mg/kg	X7SS0030002	29/29	---	66.6	Yes	210 C[11]	430[12]	IDEM	No	BSL
7440-48-4	Cobalt	6.79	22.8	mg/kg	X7SS1820002	29/29	---	22.8	No	140 N[13]	NA	NA	No	BSL
7440-50-8	Copper	6.34	427	mg/kg	X7SS0190002	29/29	---	427	Yes	310 N	14000	IDEM	Yes	ASL
7439-89-6	Iron	12200	90700	mg/kg	X7SS0030002	29/29	---	90700	Yes	5500 N	NA	NA	Yes	ASL
7439-92-1	Lead	10.3	1160	mg/kg	X7SS0550002	29/29	---	1160	Yes	400	400	IDEM	Yes	ASL
7439-95-4	Magnesium	723	7000	mg/kg	X7SS0390002	29/29	---	7000	No	NA	NA	NA	No	NUT
7439-96-5	Manganese	334	1370	mg/kg	X7SS0120002	29/29	---	1370	No	180 N	NA	NA	Yes	ASL
7440-02-0	Nickel	8.75	50.2	mg/kg	X7SS0030002	29/29	---	50.2	Yes	160 N	6900	IDEM	No	BSL
7440-09-7	Potassium	476	2380	mg/kg	X7SS1670002	29/29	---	2380	No	NA	NA	NA	No	NUT
7782-49-2	Selenium	0.249	0.913	mg/kg	X7SS1830002	29/29	---	0.913	Yes	510 N	1700	IDEM	No	BSL
7440-22-4	Silver	0.0593	0.238	mg/kg	X7SS1830002	29/29	---	0.238	Yes	510 N	1700	IDEM	No	BSL
7440-23-5	Sodium	40.9	138	mg/kg	7SS1800002, X7SS183000	6/29	16.1 - 106	138	No	NA	NA	NA	No	NUT
7440-28-0	Thallium	0.0808	0.525	mg/kg	X7SS1830002	28/29	0.128 - 0.128	0.525	No	0.52 N	24	NA	Yes	ASL
7440-62-2	Vanadium	19.9	85.9	mg/kg	X7SS1830002	29/29	---	85.9	Yes	7.8 N	NA	NA	Yes	ASL
7440-66-6	Zinc	30.9	148	mg/kg	X7SS0190002	29/29	---	148	Yes	2300 N	100000	IDEM	No	BSL
Field XRF (mg/kg)														
7439-92-1	Lead	18	741	mg/kg	X7SS0550002	151/189	---	741	Yes	400	400	IDEM	Yes	ASL

TABLE 2.1

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Footnotes

1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - Background was not used to select COPCs (Section 7.2.2.1 of text).
5 - U.S. EPA Region 9 Preliminary Remediation Goal (PRG). The noncarcinogenic values (denoted with a "N" flag) are the PRG divided by 10 to correspond to a target hazard quotient of 0.1. Carcinogenic values represent an incremental cancer risk of 1.0E-06 (carcinogens denoted with a "C" flag) (U.S. EPA Region 9, October 2004, Updated December 28, 2004).
6 - Indiana Department of Environmental Management (IDEM), Risk Integrated System of Closure (RISC) residential closure levels for soil (January 2006).
7 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level.
Chemicals selected as COPCs are indicated by shaded chemical names.
8 - The value for naphthalene was used as a surrogate for 2-methylnaphthalene.
9 - The value for acenaphthene was used as a surrogate for acenaphthylene.
10 - The value for pyrene is used as a surrogate for benzo(g,h,i)perylene and phenanthrene.
11 - The PRG for residential land use for total chromium is presented.
12 - Value is for hexavalent chromium.
13 - One-tenth of the noncarcinogenic PRG is less than the carcinogenic PRG; therefore, the one-tenth noncarcinogenic PRG is presented.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirements/To Be C
C = Carcinogen
COPC = Chemical of potential concern
J = Estimated value
N = Noncarcinogen
NA = Not applicable/not available
PRG = Preliminary Remediation Goal

Rationale Codes:
For selection as a COPC:
ASL = Above Screening Level

For elimination as a COPC:
BSL = Below Screening Level
NTX = No Toxicity Data
NUT = Essential Nutrient

TABLE 2.2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL -MIGRATION PATHWAYS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Sample with Maximum Concentration	Frequency of Detection	Range of Non-Detects(2)	Concentration Used for Screening(3)	Site above Background ?(4)	USEPA SSLs for Migration from Soil to Groundwater(5)	IDEM Criteria Migration from Soil to Groundwater(6)	USEPA SSLs for Migration from Soil to Air Residential (5)		USEPA SSLs for Migration from Soil to Air Construction (7)		COPC Flag	Rationale for Contaminant Deletion or Selection(8)
Semivolatile Organic Compounds																	
91-57-6	2-methylnaphthalene	3.9 J	40	ug/kg	X7SS1210002	3/11	1.6 - 1.8	40	NA	31000	700	NA		NA		No	BSL
83-32-9	Acenaphthene	4.9 J	550 J	ug/kg	X7SS1210002	4/11	1.1 - 1.3	550	NA	31000	130000	NA		NA		No	BSL
208-96-8	Acenaphthylene	27	27	ug/kg	X7SS1230002	1/11	0.63 - 0.75	27	NA	31000	18000	NA		NA		No	BSL
120-12-7	Anthracene	4.2 J	970	ug/kg	X7SS1210002	5/11	0.83 - 0.96	970	NA	650000	51000	NA		NA		No	BSL
56-55-3	Benzo(a)anthracene	10	6400	ug/kg	X7SS1210002	7/11	0.87 - 0.95	6400	NA	160	19000	NA		NA		Yes	ASL
50-32-8	Benzo(a)pyrene	14	8100 J	ug/kg	X7SS1210002	7/11	0.96 - 1	8100	NA	410	8200	NA		280000	C	Yes	ASL
205-99-2	Benzo(b)fluoranthene	20	12000 J	ug/kg	X7SS1210002	7/11	0.87 - 0.95	12000	NA	490	57000	NA		NA		Yes	ASL
191-24-2	Benzo(g,h,i)perylene	5.7 J	2900 J	ug/kg	X7SS1210002	7/11	0.96 - 1	2900	NA	230000	570000	NA		NA		No	BSL
207-08-9	Benzo(k)fluoranthene	6.4 J	4700 J	ug/kg	X7SS1210002	7/11	0.45 - 0.49	4700	NA	490	39000	NA		NA		Yes	ASL
218-01-9	Chrysene	13	7400	ug/kg	X7SS1210002	7/11	0.83 - 0.9	7400	NA	160	25000	NA		NA		Yes	ASL
53-70-3	Dibenzo(a,h)anthracene	18	970 J	ug/kg	X7SS1210002	4/11	1 - 1.2	970	NA	1500	18000	NA		NA		No	BSL
206-44-0	Fluoranthene	14	8700	ug/kg	X7SS1210002	7/11	0.83 - 0.9	8700	NA	310	880000	NA		NA		Yes	ASL
86-73-7	Fluorene	4.6 J	270	ug/kg	X7SS1210002	4/11	0.64 - 0.74	270	NA	41000	170000	NA		NA		No	BSL
193-39-5	Indeno(1,2,3-cd)pyrene	4.7 J	2900 J	ug/kg	X7SS1210002	7/11	1.2 - 1.3	2900	NA	1400	3100	NA		NA		Yes	ASL
85-01-8	Phenanthrene	21	4900	ug/kg	X7SS1210002	5/11	1 - 1.2	4900	NA	230000	13000	NA		NA		No	BSL
129-00-0	Pyrene	3.2 J	14000	ug/kg	X7SS1210002	8/11	1 - 1.1	14000	NA	230000	570000	NA		NA		No	BSL
Inorganics																	
7429-90-5	Aluminum	7910	19400	mg/kg	X7SS1270002,	29/29	---	19400	Yes	NA	NA	709000	N	NA		No	BSL
7440-36-0	Antimony	0.21 J	96.2 J	mg/kg	X7SS0390002	26/29	0.38 - 0.71	96.2	Yes	0.27	5.4	NA		NA		Yes	ASL
7440-38-2	Arsenic	3.86	17	mg/kg	X7SS1830002	29/29	---	17	Yes	0.29	5.8	769	C	58	C	Yes	ASL
7440-39-3	Barium	56.2	949	mg/kg	X7SS0040002	29/29	---	949	No	82	1600	70900	N	170	N	Yes	ASL
7440-41-7	Beryllium	0.407	1.35	mg/kg	X7SS0030002	29/29	---	1.35	Yes	3.2	63	1380	C	7.1	N	No	BSL
7440-43-9	Cadmium	0.387	2.21	mg/kg	X7SS1750002	29/29	---	2.21	No	0.38	7.5	1840	C	140	C	Yes	ASL
7440-70-2	Calcium	735	26700	mg/kg	X7SS0390002	29/29	---	26700	No	NA	NA	NA		NA		No	NUT
7440-47-3	Chromium	10.2	66.6	mg/kg	X7SS0030002	29/29	---	66.6	Yes	2.1	38	276	C	21	C	Yes	ASL
7440-48-4	Cobalt	6.79	22.8	mg/kg	X7SS1820002	29/29	---	22.8	No	0.17	NA	1180	C	NA		Yes	ASL
7440-50-8	Copper	6.34	427	mg/kg	X7SS0190002	29/29	---	427	Yes	560	920	NA		NA		No	BSL
7439-89-6	Iron	12200	90700	mg/kg	X7SS0030002	29/29	---	90700	Yes	NA	NA	NA		NA		Yes	ASL
7439-92-1	Lead	10.3	1160	mg/kg	X7SS0550002	29/29	---	1160	Yes	NA	81	NA		NA		Yes	ASL
7439-95-4	Magnesium	723	7000	mg/kg	X7SS0390002	29/29	---	7000	No	NA	NA	NA		NA		No	NUT
7439-96-5	Manganese	334	1370	mg/kg	X7SS0120002	29/29	---	1370	No	110	NA	70900	N	18	N	Yes	ASL
7440-02-0	Nickel	8.75	50.2	mg/kg	X7SS0030002	29/29	---	50.2	Yes	14	950	NA		NA		Yes	ASL
7440-09-7	Potassium	476	2380	mg/kg	X7SS1670002	29/29	---	2380	No	NA	NA	NA		NA		No	NUT
7782-49-2	Selenium	0.249	0.913	mg/kg	X7SS1830002	29/29	---	0.913	Yes	0.26	5.2	NA		NA		Yes	ASL
7440-22-4	Silver	0.0593	0.238	mg/kg	X7SS1830002	29/29	---	0.238	Yes	1.6	31	NA		NA		No	BSL
7440-23-5	Sodium	40.9	138	mg/kg	7SS1800002, X7SS183000	6/29	16.1 - 106	138	No	NA	NA	NA		NA		No	NUT
7440-28-0	Thallium	0.0808	0.525	mg/kg	X7SS1830002	28/29	0.128 - 0.128	0.525	No	0.056	2.8	NA		NA		Yes	ASL
7440-62-2	Vanadium	19.9	85.9	mg/kg	X7SS1830002	29/29	---	85.9	Yes	260	NA	NA		NA		No	BSL
7440-66-6	Zinc	30.9	148	mg/kg	X7SS0190002	29/29	---	148	Yes	680	14000	NA		NA		No	BSL
Field XRF (mg/kg)																	
7439-92-1	Lead	18	741	mg/kg	X7SS0550002	151/189	---	741	Yes	NA	81	NA		NA		Yes	ASL

Footnotes
Footnotes
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - Background was not used to select COPCs (Section 7.2.2.1 of text).
5 - U.S. EPA Soil Screening Levels (SSLs). U.S. EPA Internet Site at http://risk.lsd.ornl.gov/calc_start.htm (soil to air SSLs for noncarcinogens are divided by 10).
The migration to groundwater value represents a dilution attenuation factor (DAF) of 1.
6 - Indiana Department of Environmental Management (IDEM), Risk Integrated System of Closure (RISC) residential closure levels for soil (January 2006).
7 - U.S. EPA soil screening levels (SSLs) for the inhalation of volatiles and fugitive dusts for construction workers calculated based on methodology from the.
U.S. EPA's Soil Screening Guidance (USEPA, July 1996 and December 2002).
8 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level.
Chemicals selected as COPCs are indicated by shaded chemical names.

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirements/To Be Considered
C = Carcinogen
COPC = Chemical of potential concern
J = Estimated value
N = Noncarcinogen
NA = Not applicable/not available
PRG = Preliminary Remediation Goal

Rationale Codes:
For selection as a COPC:
ASL = Above Screening Level

For elimination as a COPC:

TABLE 2.2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL -MIGRATION PATHWAYS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

BSL = Below Screening Level
NTX = No Toxicity Data
NUT = Essential Nutrient

TABLE 3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site

Chemical of Potential *Concern*	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Benzo(a)anthracene	mg/kg	0.77	NA	6.4		mg/kg	1.9	UCL	Kaplan Meier (BCA) UCL	1.9	UCL	Kaplan Meier (BCA) UCL
Benzo(a)pyrene	mg/kg	0.99	NA	8.1	J	mg/kg	2.4	UCL	Kaplan Meier (BCA) UCL	2.4	UCL	Kaplan Meier (BCA) UCL
Benzo(b)fluoranthene	mg/kg	1.5	NA	12	J	mg/kg	3.6	UCL	Kaplan Meier (BCA) UCL	3.6	UCL	Kaplan Meier (BCA) UCL
Benzo(k)fluoranthene	mg/kg	0.57	NA	4.7	J	mg/kg	1.4	UCL	Kaplan Meier (BCA) UCL	1.4	UCL	Kaplan Meier (BCA) UCL
Chrysene	mg/kg	0.9	NA	7.4		mg/kg	2.2	UCL	Kaplan Meier (BCA) UCL	2.2	UCL	Kaplan Meier (BCA) UCL
Dibenzo(a,h)anthracene	mg/kg	0.11	NA	0.97	J	mg/kg	0.29	UCL	Kaplan Meier (t) UCL	0.29	UCL	Kaplan Meier (t) UCL
Indeno(1,2,3-cd)pyrene	mg/kg	0.36	NA	2.9	J	mg/kg	0.86	UCL	Kaplan Meier (BCA) UCL	0.86	UCL	Kaplan Meier (BCA) UCL
Aluminum	mg/kg	13500	NA	19400		mg/kg	14500	Student T	Student's T UCL	14500	Student T	Student's T UCL
Antimony	mg/kg	8	NA	96.2	J	mg/kg	25.5	UCL	*Kaplan Meier (Chebyshev)* UCL	25.5	UCL	Kaplan Meier (Chebyshev) UCL
Arsenic	mg/kg	10	NA	17		mg/kg	11	Student T	Student's T UCL	11	Student T	Student's T UCL
Barium	mg/kg	172	NA	949		mg/kg	361	UCL	Chebyshev (Mean, Sd) UCL	361	UCL	Chebyshev (Mean, Sd) UCL
Copper	mg/kg	74.9	NA	427		mg/kg	102	UCL	Approximate Gamma UCL	102	UCL	Approximate Gamma UCL
Iron	mg/kg	33700	NA	90700		mg/kg	38000	UCL	Approximate Gamma UCL	38000	UCL	Approximate Gamma UCL
Manganese	mg/kg	812.00	NA	1370		mg/kg	903	Student T	Student's T UCL	903	Student T	Student's T UCL
Thallium	mg/kg	0.2	NA	0.525		mg/kg	0.28	UCL	Kaplan Meier (Chebyshev) UCL	0.28	UCL	Kaplan Meier (Chebyshev) UCL
Vanadium	mg/kg	39.8	NA	85.9		mg/kg	45.1	Student T	Modified T UCL	45.1	Student T	Modified T UCL
Lead	mg/kg	225	NA	1160		mg/kg	225	UCL	Approximate Gamma UCL	225	UCL	Approximate Gamma UCL

TABLE 4.1
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF CONSTRUCTION WORKERS TO SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Ingestion CDI[1] (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	330	U.S. EPA, December 2002	165	Professional Judgement	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1.0	U.S. EPA, May 1993	1.0	U.S. EPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	150	Professional Judgement	150	Professional Judgement	U.S. EPA, December 1989
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	365	U.S. EPA, December 1989	365	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Dermal CDI[1] (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,300	U.S. EPA, December 2002	3,300	U.S. EPA, December 2002	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.3	U.S. EPA, December 2002	0.1	U.S. EPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, July 2004	chemical specific	U.S. EPA, July 2004	
	EF	Exposure Frequency	days/year	150	Professional Judgement	150	Professional Judgement	
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	365	U.S. EPA, December 1989	365	U.S. EPA, December 1989	

1 CDI = Chronic Daily Intake

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)

Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 2.77E-08
Noncancer Ingestion Intake - RME = 1.94E-06

Cancer Ingestion Intake - CTE = 1.38E-08
Noncancer Ingestion Intake - CTE = 9.69E-07

Cancer Dermal Intake - RME = 8.30E-08
Noncancer Dermal Intake - RME = 5.81E-06

Cancer Dermal Intake - CTE = 2.77E-08
Noncancer Dermal Intake - CTE = 1.94E-06

TABLE 4.2
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF MAINTENANCE WORKERS TO SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Maintenance Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Ingestion CDI[1] (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	U.S. EPA, May 1993	50	U.S. EPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1.0	U.S. EPA, May 1993	1.0	U.S. EPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	24	Professional Judgement	12	Professional Judgement	U.S. EPA, December 1989
	ED	Exposure Duration	years	25	U.S. EPA, May 1993	9	U.S. EPA, May 1993	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	U.S. EPA, December 1989	3,285	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Dermal CDI[1] (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,300	U.S. EPA, July 2004	3,300	U.S. EPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	U.S. EPA, July 2004	0.02	U.S. EPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, July 2004	chemical specific	U.S. EPA, July 2004	
	EF	Exposure Frequency	days/year	24	Professional Judgement	12	Professional Judgement	
	ED	Exposure Duration	years	25	U.S. EPA, May 1993	9	U.S. EPA, May 1993	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	U.S. EPA, December 1989	3,285	U.S. EPA, December 1989	

1 CDI = Chronic Daily Intake

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 3.35E-08
Noncancer Ingestion Intake - RME = 9.39E-08

Cancer Ingestion Intake - CTE = 3.02E-09
Noncancer Ingestion Intake - CTE = 2.35E-08

Cancer Dermal Intake - RME = 2.21E-07
Noncancer Dermal Intake - RME = 6.20E-07

Cancer Dermal Intake - CTE = 3.99E-09
Noncancer Dermal Intake - CTE = 3.10E-08

TABLE 4.3
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF OCCUPATIONAL WORKERS TO SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Ingestion CDI(1) (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	U.S. EPA, May 1993	50	U.S. EPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1.0	U.S. EPA, May 1993	1.0	U.S. EPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	250	U.S. EPA, May 1993	219	U.S. EPA, May 1993	U.S. EPA, December 1989
	ED	Exposure Duration	years	25	U.S. EPA, May 1993	9	U.S. EPA, May 1993	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	U.S. EPA, December 1989	3,285	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Dermal CDI(1) (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,300	U.S. EPA, July 2004	3,300	U.S. EPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	U.S. EPA, July 2004	0.02	U.S. EPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, July 2004	chemical specific	U.S. EPA, July 2004	
	EF	Exposure Frequency	days/year	250	U.S. EPA, May 1993	219	U.S. EPA, May 1993	
	ED	Exposure Duration	years	25	U.S. EPA, December 1989	9	U.S. EPA, December 1989	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	9,125	U.S. EPA, December 1989	3,285	U.S. EPA, December 1989	

1 CDI = Chronic Daily Intake

Daily Intake Calculations
Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 3.49E-07
Noncancer Ingestion Intake - RME = 9.78E-07

Cancer Ingestion Intake - CTE = 5.51E-08
Noncancer Ingestion Intake - CTE = 4.29E-07

Cancer Dermal Intake - RME = 2.31E-06
Noncancer Dermal Intake - RME = 6.46E-06

Cancer Dermal Intake - CTE = 7.27E-08
Noncancer Dermal Intake - CTE = 5.66E-07

TABLE 4.4
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF ADOLESCENT TRESPASSERS TO SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (age 6 - 17)

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Ingestion CDI[1] (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	U.S. EPA, May 1993	50	U.S. EPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1.0	U.S. EPA, May 1993	1.0	U.S. EPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	26	Professional Judgement	13	Professional Judgement	U.S. EPA, December 1989
	ED	Exposure Duration	years	11	6 - 17 years of age	11	6 - 17 years of age	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	43	U.S. EPA, August 1997	43	U.S. EPA, August 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	4,015	U.S. EPA, December 1989	4,015	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Dermal CDI[1] (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,280	U.S. EPA, August 1997	3,100	U.S. EPA, August 1997	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	U.S. EPA, July 2004	0.04	U.S. EPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, July 2004	chemical specific	U.S. EPA, July 2004	
	EF	Exposure Frequency	days/year	26	Professional Judgement	13	Professional Judgement	
	ED	Exposure Duration	years	11	6 - 17 years of age	11	6 - 17 years of age	
	BW	Body Weight	kg	43	U.S. EPA, August 1997	43	U.S. EPA, August 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	4,015	U.S. EPA, December 1989	4,015	U.S. EPA, December 1989	

1 CDI = Chronic Daily Intake

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 2.60E-08
Noncancer Ingestion Intake - RME = 1.66E-07

Cancer Ingestion Intake - CTE = 6.51E-09
Noncancer Ingestion Intake - CTE = 4.14E-08

Cancer Dermal Intake - RME = 1.71E-07
Noncancer Dermal Intake - RME = 1.09E-06

Cancer Dermal Intake - CTE = 1.61E-08
Noncancer Dermal Intake - CTE = 1.03E-07

TABLE 4.5
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF CHILD RECREATIONAL USERS TO SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Ingestion CDI(1) (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	200	U.S. EPA, May 1993	100	U.S. EPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	0.5	Professional Judgment	0.5	Professional Judgment	BW x AT
	EF	Exposure Frequency	days/year	52	Professional Judgment	26	Professional Judgment	U.S. EPA, December 1989
	ED	Exposure Duration	years	2	U.S. EPA, May 1993	2	U.S. EPA, May 1993	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	15	U.S. EPA, May 1993	15	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	730	U.S. EPA, December 1989	730	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Dermal CDI(1) (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	3,300	1/2 total body area (EPA 2004)	3,300	1/2 total body area (EPA 2004)	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	U.S. EPA, July 2004	0.04	U.S. EPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, July 2004	chemical specific	U.S. EPA, July 2004	
	EF	Exposure Frequency	days/year	52	Professional Judgment	26	Professional Judgment	
	ED	Exposure Duration	years	2	U.S. EPA, December 1989	2	U.S. EPA, December 1989	
	BW	Body Weight	kg	15	U.S. EPA, May 1993	15	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	730	U.S. EPA, December 1989	730	U.S. EPA, December 1989	

1 CDI = Chronic Daily Intake

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 2.71E-08
Noncancer Ingestion Intake - RME = 9.50E-07

Cancer Ingestion Intake - CTE = 6.78E-09
Noncancer Ingestion Intake - CTE = 2.37E-07

Cancer Dermal Intake - RME = 1.79E-07
Noncancer Dermal Intake - RME = 6.27E-06

Cancer Dermal Intake - CTE = 1.79E-08
Noncancer Dermal Intake - CTE = 6.27E-07

TABLE 4.6
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF ADULT RECREATIONAL USERS TO SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational User
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Ingestion CDI[1] (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	U.S. EPA, May 1993	50	U.S. EPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	0.5	Professional Judgment	0.5	Professional Judgment	BW x AT
	EF	Exposure Frequency	days/year	52	Professional Judgment	26	Professional Judgment	U.S. EPA, December 1989
	ED	Exposure Duration	years	10	U.S. EPA, May 1993	7	U.S. EPA, May 1993	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	U.S. EPA, December 1989	2,555	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Dermal CDI[1] (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	9,070	U.S. EPA, August 1997	9,070	U.S. EPA, August 1997	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.07	U.S. EPA, July 2004	0.01	U.S. EPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, July 2004	chemical specific	U.S. EPA, July 2004	
	EF	Exposure Frequency	days/year	52	Professional Judgment	26	Professional Judgment	
	ED	Exposure Duration	years	10	U.S. EPA, December 1989	7	U.S. EPA, December 1989	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	U.S. EPA, December 1989	2,555	U.S. EPA, December 1989	

1 CDI = Chronic Daily Intake

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 1.45E-08
Noncancer Ingestion Intake - RME = 1.02E-07

Cancer Ingestion Intake - CTE = 2.54E-09
Noncancer Ingestion Intake - CTE = 2.54E-08

Cancer Dermal Intake - RME = 1.85E-07
Noncancer Dermal Intake - RME = 1.29E-06

Cancer Dermal Intake - CTE = 9.23E-09
Noncancer Dermal Intake - CTE = 9.23E-08

TABLE 4.7
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF FUTURE CHILD RESIDENTS TO SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Ingestion CDI(1) (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	200	U.S. EPA, May 1993	100	U.S. EPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1.0	U.S. EPA, May 1993	1.0	U.S. EPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	350	U.S. EPA, May 1993	234	U.S. EPA, May 1993	U.S. EPA, December 1989
	ED	Exposure Duration	years	6	U.S. EPA, May 1993	2	U.S. EPA, May 1993	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	15	U.S. EPA, May 1993	15	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	U.S. EPA, December 1989	730	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Dermal CDI(1) (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	2,800	U.S. EPA, July 2004	2,800	U.S. EPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	U.S. EPA, July 2004	0.04	U.S. EPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, July 2004	chemical specific	U.S. EPA, July 2004	
	EF	Exposure Frequency	days/year	350	U.S. EPA, May 1993	234	U.S. EPA, May 1993	
	ED	Exposure Duration	years	6	U.S. EPA, December 1989	2	U.S. EPA, December 1989	
	BW	Body Weight	kg	15	U.S. EPA, May 1993	15	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	2,190	U.S. EPA, December 1989	730	U.S. EPA, December 1989	

1 CDI = Chronic Daily Intake

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 1.10E-06
Noncancer Ingestion Intake - RME = 1.28E-05

Cancer Dermal Intake - RME = 3.07E-06
Noncancer Dermal Intake - RME = 3.58E-05

Cancer Ingestion Intake - CTE = 1.22E-07
Noncancer Ingestion Intake - CTE = 4.27E-06

Cancer Dermal Intake - CTE = 1.37E-07
Noncancer Dermal Intake - CTE = 4.79E-06

TABLE 4.8
VALUES OF DAILY INTAKE CALCULATIONS FOR EXPOSURE OF FUTURE ADULT RESIDENTS TO SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Ingestion CDI[1] (mg/kg/day) =
	IR	Ingestion Rate of Soil	mg/day	100	U.S. EPA, May 1993	50	U.S. EPA, May 1993	Csoil x IR x Fi x EF x ED x CF
	Fi	Fraction Ingested	unitless	1.0	U.S. EPA, May 1993	1.0	U.S. EPA, May 1993	BW x AT
	EF	Exposure Frequency	days/year	350	U.S. EPA, May 1993	234	U.S. EPA, May 1993	U.S. EPA, December 1989
	ED	Exposure Duration	years	10	U.S. EPA, May 1993	7	U.S. EPA, May 1993	
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	U.S. EPA, December 1989	2,555	U.S. EPA, December 1989	
Dermal	Csoil	Chemical Concentration in Soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Dermal CDI[1] (mg/kg/day) =
	CF	Conversion Factor	kg/mg	1.0E-06	U.S. EPA, December 1989	1.0E-06	U.S. EPA, December 1989	Csoil x CF x SA x AF x ABS x EF x ED
	SA	Skin Surface Area	cm^2/day	5,700	U.S. EPA, July 2004	5,700	U.S. EPA, July 2004	BW x AT
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.07	U.S. EPA, July 2004	0.01	U.S. EPA, July 2004	U.S. EPA, December 1989
	ABS	Dermal Absorption Factor (Solid)	unitless	chemical specific	U.S. EPA, July 2004	chemical specific	U.S. EPA, July 2004	
	EF	Exposure Frequency	days/year	350	U.S. EPA, May 1993	234	U.S. EPA, May 1993	
	ED	Exposure Duration	years	10	U.S. EPA, December 1989	7	U.S. EPA, December 1989	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, December 1989	25,550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	3,650	U.S. EPA, December 1989	2,555	U.S. EPA, December 1989	

1 CDI = Chronic Daily Intake

Daily Intake Calculations

Ingestion Intake = (IR x Fi x EF x ED x CF) / (BW x AT)
Dermal Intake = (CF x SA x AF x ABS x EF x ED) / (BW x AT)

Cancer Ingestion Intake - RME = 1.96E-07
Noncancer Ingestion Intake - RME = 1.37E-06

Cancer Ingestion Intake - CTE = 4.58E-08
Noncancer Ingestion Intake - CTE = 4.58E-07

Cancer Dermal Intake - RME = 7.81E-07
Noncancer Dermal Intake - RME = 5.47E-06

Cancer Dermal Intake - CTE = 5.22E-08
Noncancer Dermal Intake - CTE = 5.22E-07

TABLE 4.9

VALUES USED FOR DAILY INTAKE CALCULATIONS
EXPOSURE OF CONSTRUCTION/EXCAVATION WORKERS BY INHALATION FROM SURFACE SOIL
UXO 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction/Excavation Workers
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical concentration in soil	mg/kg	95% UCL or Max	U.S. EPA, December 2002	95% UCL or Max	U.S. EPA, December 2002	Intake (mg/kg/day) =
	VF	Volatilization factor	m^3/kg	Chemical Specific	U.S. EPA, December 2002	Chemical Specific	U.S. EPA, December 2002	$\dfrac{CS \times IR \times \left[\dfrac{1}{VF} + \dfrac{1}{PEF}\right] \times ET \times EF \times ED}{BW \times AT}$
	PEF	Particulate emission factor	m^3/kg	1.50E+06	U.S. EPA, December 2002	1.50E+06	U.S. EPA, December 2002	
	IR	Inhalation Rate	m^3/hour	2.5	U.S. EPA, August 1997	2.5	U.S. EPA, August 1997	
	ET	Exposure Time	hours/day	8	Professional Judgement	8	Professional Judgement	
	EF	Exposure Frequency	days/year	150	Professional Judgement	150	Professional Judgement	
	ED	Exposure Duration	years	1	Professional Judgement	1	Professional Judgement	
	BW	Body Weight	kg	70	U.S. EPA, May 1993	70	U.S. EPA, May 1993	
	AT-C	Averaging Time (Cancer)	days	25550	U.S. EPA, December 1989	25550	U.S. EPA, December 1989	
	AT-N	Averaging Time (Non-Cancer)	days	365	U.S. EPA, December 1989	365	U.S. EPA, December 1989	

Daily Intake Calculations

Inhalation Intake = (IRa x ET x EF x ED x (1/PEF)+(1/VF)) / (BW x AT)

Cancer Inhalation Intake(RME) = 1.68E-03   Cancer Inhalation Intake(CTE) = 1.68E-03

Noncancer Inhalation Intake(RME) = 1.17E-01   Noncancer Inhalation Intake(CTE) = 1.17E-01

TABLE 5.1
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal[1]	Absorbed RfD for Dermal[2]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Semivolatile Organic Compounds										
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals										
Aluminum	Chronic	1.0E+00	mg/kg/day	1	1.0E+00	mg/kg/day	CNS	100	EPA 9	10/2004
Antimony	Chronic	4.0E-04	mg/kg/day	0.15	6.0E-05	mg/kg/day	Blood	1000/1	IRIS	5/20/2008
Arsenic	Chronic	3.0E-04	mg/kg/day	1	3.0E-04	mg/kg/day	Skin, CVS	3/1	IRIS	5/20/2008
Barium	Chronic	2.0E-01	mg/kg/day	0.07	1.4E-02	mg/kg/day	Kidney	300/1	IRIS	5/20/2008
Chromium (as Chromium VI)	Chronic	3.0E-03	mg/kg/day	0.025	7.5E-05	mg/kg/day	Fetotoxicity/GS/Bone	300/3	IRIS	5/20/2008
Copper	Chronic	4.0E-02	mg/kg/day	1	4.0E-02	mg/kg/day	GS	NA	HEAST	7/1997
Iron	Chronic	7.0E-01	mg/kg/day	1	7.0E-01	mg/kg/day	NA	1	NCEA	10/11/2007
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	Chronic	2.0E-02	mg/kg/day	0.04	8.0E-04	mg/kg/day	CNS	1/1	IRIS	5/20/2008
Thallium	Chronic	7.0E-05	mg/kg/day	1	7.0E-05	mg/kg/day	Liver	3000	EPA 3	10/11/2007
Vanadium	Chronic	1.0E-03	mg/kg/day	0.026	2.6E-05	mg/kg/day	Kidney	300	NCEA	10/11/2007

Notes:

1 - U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.

2 - Adjusted dermal RfD = Oral RfD x Oral Absorption Efficiency for Dermal.

Definitions:

CNS = Central Nervous System
CVS = Cardiovascular system
EPA 9 = U.S. EPA Region 9 Preliminary Remediation Goal Table, October 2004, Updated December, 2007.
GS = Gastrointestinal System
HEAST= Health Effects Assessment Summary Tables
IRIS = Integrated Risk Information System
NCEA = National Center for Environmental Assessment, value from U.S. EPA Region 3 RBC Table, October 11, 2007.
NA = Not Applicable

TABLE 5.2
NON-CANCER TOXICITY DATA -- INHALATION
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD[1]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Semivolatile Organic Compounds									
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals									
Aluminum	Chronic	3.5E-03	mg/m^3	1.0E-03	(mg/kg/day)	CNS	300	NCEA	10/11/2007
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	Chronic	5.0E-04	mg/m^3	1.4E-04	(mg/kg/day)	Fetus	1000/1	HEAST	7/1997
Chromium (as Chromium VI)	Chronic	1.0E-04	mg/m^3	3.0E-05	(mg/kg/day)	Lungs	300/1	IRIS	5/20/2008
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	Chronic	5.0E-05	mg/m^3	1.4E-05	(mg/kg/day)	CNS	1000/1	IRIS	5/20/2008
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

1 - Extrapolated RfD = RfC *$20m^3$/day / 70 kg

Definitions:

CNS = Central Nervous System
CVS = Cardiovascular system
NCEA = National Center for Environmental Assessment, value from U.S. EPA Region 3 RBC Table, October 11, 2007.
GS = Gastrointestinal System
HEAST= Health Effects Assessment Summary Tables
IRIS = Integrated Risk Information System
NA = Not Applicable

TABLE 6.1
CANCER TOXICITY DATA -- ORAL/DERMAL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal(1)	Absorbed Cancer Slope Factor for Dermal(2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Semivolatile Organic Compounds								
Benzo(a)anthracene	7.3E-01	$(mg/kg/day)^{-1}$	1	7.3E-01	$(mg/kg/day)^{-1}$	B2	EPA(1)	7/1993
Benzo(a)pyrene	7.3E+00	$(mg/kg/day)^{-1}$	1	7.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	5/20/2008
Benzo(b)fluoranthene	7.3E-01	$(mg/kg/day)^{-1}$	1	7.3E-01	$(mg/kg/day)^{-1}$	B2	EPA(1)	7/1993
Benzo(k)fluoranthene	7.3E-02	$(mg/kg/day)^{-1}$	1	7.3E-02	$(mg/kg/day)^{-1}$	B2	EPA(1)	7/1993
Chrysene	7.3E-03	$(mg/kg/day)^{-1}$	1	7.3E-03	$(mg/kg/day)^{-1}$	B2	EPA(1)	7/1993
Dibenzo(a,h)anthracene	7.3E+00	$(mg/kg/day)^{-1}$	1	7.3E+00	$(mg/kg/day)^{-1}$	B2	EPA(1)	7/1993
Indeno(1,2,3-cd)pyrene	7.3E-01	$(mg/kg/day)^{-1}$	1	7.3E-01	$(mg/kg/day)^{-1}$	B2	EPA(1)	7/1993
Metals								
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	1.5E+00	$(mg/kg/day)^{-1}$	1	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	5/20/2008
Barium	NA	NA	NA	NA	NA	NA	IRIS	5/20/2008
Chromium (as Chromium VI)	NA	NA	NA	NA	NA	D	IRIS	5/20/2008
Copper	NA	NA	NA	NA	NA	D	IRIS	5/20/2008
Iron	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	B2	IRIS	5/20/2008
Manganese	NA	NA	NA	NA	NA	D	IRIS	5/20/2008
Thallium	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

1 - U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.

2 - Adjusted cancer slope factor for dermal = Oral cancer slope factor / Oral Absorption Efficiency for Dermal.

IRIS = Integrated Risk Information System.

NA = Not Available.

EPA(1) = U.S. EPA, Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons, July 1993, EPA/600/R-93/089.

EPA Group:

- A - Human carcinogen.
- B1 - Probable human carcinogen - indicates that limited human data are available.
- B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans .
- C - Possible human carcinogen.
- D - Not classifiable as a human carcinogen.
- E - Evidence of noncarcinogenicity.

TABLE 6.2
CANCER TOXICITY DATA -- INHALATION
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor[1]		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Semivolatile Organic Compounds							
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	8.9E-01	$(mg/m^3)^{-1}$	3.1E+00	$(mg/kg/day)^{-1}$	B2	NCEA	10/11/2007
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA
Metals							
Aluminum	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA
Arsenic	4.3E+00	$(mg/m^3)^{-1}$	1.5E+01	$(mg/kg/day)^{-1}$	A	IRIS	5/20/2008
Barium	NA	NA	NA	NA	D	IRIS	5/20/2008
Chromium	1.2E+01	$(mg/m^3)^{-1}$	4.2E+01	$(mg/kg/day)^{-1}$	A	IRIS	5/20/2008
Copper	NA	NA	NA	NA	D	IRIS	5/20/2008
Iron	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	B2	IRIS	5/20/2008
Manganese	NA	NA	NA	NA	D	IRIS	5/20/2008
Thallium	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA

Notes:
1 - Inhalation CSF = Unit Risk * 70 kg / $20m^3$/day.

Definitions:
IRIS = Integrated Risk Information System.
NA = Not Available.
NCEA = National Center for Environmental Assessment, value from U.S. EPA Region 3 RBC Table, October 11, 2007.

EPA Group:
A - Human carcinogen.
B1 - Probable human carcinogen - indicates that limited human data are available.
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans .
C - Possible human carcinogen.
D - Not classifiable as a human carcinogen.
E - Evidence of noncarcinogenicity.

TABLE 7.1 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	3.7E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	4.6E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	7.0E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	2.7E-06	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	4.3E-06	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	5.6E-07	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.7E-06	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	2.8E-02	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	2.8E-02
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	4.9E-05	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	1.2E-01
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.1E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	7.1E-02
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	7.0E-04	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	3.5E-03
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	2.0E-04	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	4.9E-03
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	7.4E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	1.1E-01
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	1.7E-03	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	8.7E-02
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	5.4E-07	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	7.7E-03
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	8.7E-05	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	8.7E-02
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	4.4E-04	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**5.2E-01**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.4E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.8E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	2.7E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.1E-06	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.7E-06	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.2E-07	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	6.5E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.9E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	6.4E-03
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**6.4E-03**
												Total Hazard Index Across All Exposure Routes/Pathways	**5.3E-01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - *0.13* Arsenic - *0.03*

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.2 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF MAINTENANCE WORKERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Maintenance Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.8E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.3E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	3.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.3E-07	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.1E-07	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.7E-08	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	8.1E-08	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	1.4E-03	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	1.4E-03
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	2.4E-06	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	6.0E-03
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.0E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.4E-03
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	3.4E-05	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	1.7E-04
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	9.6E-06	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	2.4E-04
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	3.6E-03	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	5.1E-03
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	8.5E-05	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	4.2E-03
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	2.6E-08	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	3.8E-04
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	4.2E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	4.2E-03
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	2.1E-05	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**2.5E-02**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.5E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.9E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	2.9E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.1E-07	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.8E-07	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.3E-08	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	6.9E-08	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.0E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	6.8E-04
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**6.8E-04**
												Total Hazard Index Across All Exposure Routes/Pathways	**2.6E-02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.3 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF OCCUPATIONAL WORKERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.9E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.3E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	3.5E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.4E-06	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.2E-06	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.8E-07	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	8.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	1.4E-02	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	1.4E-02
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	2.5E-05	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	6.2E-02
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.1E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.6E-02
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	3.5E-04	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	1.8E-03
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	1.0E-04	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	2.5E-03
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	3.7E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	5.3E-02
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	8.8E-04	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	4.4E-02
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	2.7E-07	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	3.9E-03
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	4.4E-05	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	4.4E-02
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	2.2E-04	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**2.6E-01**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.6E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.0E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	3.0E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.2E-06	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.8E-06	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	7.2E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.1E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	7.1E-03
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**7.1E-03**
												Total Hazard Index Across All Exposure Routes/Pathways	**2.7E-01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.4 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF ADOLESCENT TRESPASSERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (age 6 - 17)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	3.1E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	4.0E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	6.0E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	2.3E-07	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	3.6E-07	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	4.8E-08	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	2.4E-03	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	2.4E-03
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	4.2E-06	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	1.1E-02
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.8E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	6.1E-03
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	6.0E-05	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	3.0E-04
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	1.7E-05	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	4.2E-04
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	6.3E-03	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	9.0E-03
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	1.5E-04	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	7.5E-03
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	4.6E-08	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	6.6E-04
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	7.5E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	7.5E-03
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	3.7E-05	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**4.4E-02**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.7E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	3.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	5.1E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	2.0E-07	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	3.1E-07	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	4.1E-08	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.2E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	3.6E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.2E-03
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**1.2E-03**
												Total Hazard Index Across All Exposure Routes/Pathways	**4.6E-02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.5 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CHILD RECREATIONAL USERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.6E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.3E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	3.4E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.3E-06	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.1E-06	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.8E-07	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	8.2E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	1.4E-02	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	1.4E-02
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	2.4E-05	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	6.1E-02
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.0E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.5E-02
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	3.4E-04	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	1.7E-03
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	9.7E-05	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	2.4E-03
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	3.6E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	5.2E-02
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	8.6E-04	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	4.3E-02
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	2.7E-07	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	3.8E-03
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	4.3E-05	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	4.3E-02
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	2.1E-04	mg/kg-day		mg/kg-day	NA	NA	
	(total)												2.5E-01
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.5E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.0E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	2.9E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.1E-06	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.8E-06	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	7.0E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.1E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	6.9E-03
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												6.9E-03
												Total Hazard Index Across All Exposure Routes/Pathways	**2.6E-01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.6 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF ADULT RECREATIONAL USERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational User
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.9E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	3.7E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.2E-07	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	3.0E-08	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	8.8E-08	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	1.5E-03	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	1.5E-03
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	2.6E-06	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	6.5E-03
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.1E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.7E-03
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	3.7E-05	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	1.8E-04
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	1.0E-05	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	2.6E-04
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	3.9E-03	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	5.5E-03
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	9.2E-05	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	4.6E-03
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	2.8E-08	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	4.1E-04
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	4.6E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	4.6E-03
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	2.3E-05	mg/kg-day		mg/kg-day	NA	NA	
	(total)												2.7E-02
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	3.2E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	4.0E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	6.0E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	2.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	3.7E-07	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	4.9E-08	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	4.3E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.4E-03
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												1.4E-03
												Total Hazard Index Across All Exposure Routes/Pathways	**2.9E-02**

(1) *Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.*

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13   Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.7 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF FUTURE CHILD RESIDENTS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.4E-05	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	3.1E-05	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	4.6E-05	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.8E-05	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.8E-05	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	3.7E-06	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.1E-05	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	1.9E-01	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	1.9E-01
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	3.3E-04	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	8.2E-01
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.4E-04	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	4.7E-01
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	4.6E-03	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	2.3E-02
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	1.3E-03	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	3.3E-02
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	4.9E-01	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	6.9E-01
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	1.2E-02	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	5.8E-01
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	3.6E-06	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	5.1E-02
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	5.8E-04	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	5.8E-01
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	2.9E-03	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**3.4E+00**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	8.8E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.1E-05	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.7E-05	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	6.5E-06	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.0E-05	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.3E-06	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	4.0E-06	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.2E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.9E-02
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**3.9E-02**
												Total Hazard Index Across All Exposure Routes/Pathways	**3.5E+00**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.8 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF FUTURE ADULT RESIDENTS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.6E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	3.3E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	4.9E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.9E-06	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	3.0E-06	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	4.0E-07	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.2E-06	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	2.0E-02	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	2.0E-02
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	3.5E-05	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	8.7E-02
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.5E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	5.0E-02
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	4.9E-04	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	2.5E-03
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	1.4E-04	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	3.5E-03
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	5.2E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	7.4E-02
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	1.2E-03	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	6.2E-02
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	3.8E-07	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	5.5E-03
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	6.2E-05	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	6.2E-02
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	3.1E-04	mg/kg-day		mg/kg-day	NA	NA	
	(total)												3.7E-01
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.4E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.7E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	2.6E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	9.9E-07	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.6E-06	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.1E-07	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	6.1E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.8E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	6.0E-03
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												6.0E-03
												Total Hazard Index Across All Exposure Routes/Pathways	3.7E-01

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.9. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF CONSTRUCTION/EXCAVATION WORKERS BY INHALATION FROM SURFACE SOIL
UXO 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction/Excavation Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	Barium	3.61E+02	mg/kg	2.40E-04	mg/m^3	R	2.8E-05	mg/kg-day	1.40E-04	mg/kg-day	4.90E-04	mg/m^3	2.0E-01
	Chromium	3.09E+01	mg/kg	2.06E-05	mg/m^3	R	2.4E-06	mg/kg-day	3.00E-05	mg/kg-day	1.05E-04	mg/m^3	8.1E-02
	Manganese	9.03E+02	mg/kg	6.01E-04	mg/m^3	R	7.1E-05	mg/kg-day	1.40E-05	mg/kg-day	4.9E-05	mg/m^3	5.0E+00
	(total)												5.3E+00
										Total Hazard Index Across All Exposure Routes/Pathways			**5.3E+00**

TABLE 7.1a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.8E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.3E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	3.5E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.4E-06	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.1E-06	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.8E-07	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	8.3E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	1.4E-02	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	1.4E-02
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	2.5E-05	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	6.2E-02
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.1E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.6E-02
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	3.5E-04	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	1.7E-03
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	9.9E-05	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	2.5E-03
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	3.7E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	5.3E-02
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	8.7E-04	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	4.4E-02
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	2.7E-07	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	3.9E-03
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	4.4E-05	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	4.4E-02
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	2.2E-04	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**2.6E-01**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	4.8E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	6.0E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	9.1E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.5E-07	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	5.5E-07	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	7.3E-08	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.2E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	6.4E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.1E-03
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**2.1E-03**
												Total Hazard Index Across All Exposure Routes/Pathways	**2.6E-01**

(1) *Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.*

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.2a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF MAINTENANCE WORKERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Maintenance Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	4.5E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	5.6E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	8.5E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.3E-08	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	5.2E-08	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	6.8E-09	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.0E-08	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	3.4E-04	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	3.4E-04
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	6.0E-07	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	1.5E-03
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.6E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	8.6E-04
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	8.5E-06	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	4.2E-05
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	2.4E-06	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	6.0E-05
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	8.9E-04	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	1.3E-03
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	2.1E-05	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.1E-03
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	6.6E-09	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	9.4E-05
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.1E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	1.1E-03
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	5.3E-06	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**6.3E-03**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	7.7E-09	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	9.7E-09	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.5E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	5.6E-09	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	8.9E-09	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.2E-09	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	3.5E-09	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.0E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.4E-05
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**3.4E-05**
												Total Hazard Index Across All Exposure Routes/Pathways	**6.3E-03**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.3a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF OCCUPATIONAL WORKERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	8.1E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.0E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.5E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	6.0E-07	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	9.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.2E-07	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	3.7E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	6.2E-03	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	6.2E-03
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	1.1E-05	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	2.7E-02
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	4.7E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.6E-02
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	1.5E-04	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	7.7E-04
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	4.4E-05	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	1.1E-03
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	1.6E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	2.3E-02
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	3.9E-04	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.9E-02
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	1.2E-07	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	1.7E-03
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.9E-05	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	1.9E-02
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	9.6E-05	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**1.1E-01**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.8E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	2.6E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.0E-07	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.6E-07	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.1E-08	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	6.3E-08	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.9E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	6.2E-04
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**6.2E-04**
												Total Hazard Index Across All Exposure Routes/Pathways	**1.2E-01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.4a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF ADOLESCENT TRESPASSERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (age 6 - 17)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	7.9E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	9.9E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.5E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	5.8E-08	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	9.1E-08	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.2E-08	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	3.6E-08	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	6.0E-04	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	6.0E-04
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	1.1E-06	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	2.6E-03
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	4.6E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.5E-03
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	1.5E-05	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	7.5E-05
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	4.2E-06	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	1.1E-04
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	1.6E-03	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	2.2E-03
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	3.7E-05	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.9E-03
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	1.2E-08	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	1.7E-04
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.9E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	1.9E-03
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	9.3E-06	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**1.1E-02**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.5E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	3.2E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	4.8E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.9E-08	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.9E-08	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	3.9E-09	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.1E-08	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	3.4E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.1E-04
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**1.1E-04**
												Total Hazard Index Across All Exposure Routes/Pathways	**1.1E-02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.5a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF CHILD RECREATIONAL USERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	4.5E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	5.7E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	8.5E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.3E-07	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	5.2E-07	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	6.9E-08	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.0E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	3.4E-03	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	3.4E-03
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	6.1E-06	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	1.5E-02
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.6E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	8.7E-03
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	8.6E-05	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	4.3E-04
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	2.4E-05	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	6.1E-04
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	9.0E-03	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	1.3E-02
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	2.1E-04	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.1E-02
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	6.6E-08	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	9.5E-04
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.1E-05	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	1.1E-02
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	5.3E-05	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**6.4E-02**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.5E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.0E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	2.9E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.1E-07	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.8E-07	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.4E-08	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	7.0E-08	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.1E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	6.9E-04
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												**6.9E-04**
												Total Hazard Index Across All Exposure Routes/Pathways	**6.4E-02**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.6a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF ADULT RECREATIONAL USERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational User
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	4.8E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	6.1E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	9.2E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.6E-08	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	5.6E-08	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	7.4E-09	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.2E-08	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	3.7E-04	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	3.7E-04
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	6.5E-07	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	1.6E-03
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.8E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	9.3E-04
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	9.2E-06	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	4.6E-05
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	2.6E-06	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	6.5E-05
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	9.7E-04	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	1.4E-03
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	2.3E-05	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.1E-03
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	7.1E-09	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	1.0E-04
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.1E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	1.1E-03
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	5.7E-06	mg/kg-day		mg/kg-day	NA	NA	
	(total)												6.8E-03
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.3E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.9E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	4.3E-08	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.7E-08	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.6E-08	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	3.5E-09	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.0E-08	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	3.0E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.0E-04
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												1.0E-04
												Total Hazard Index Across All Exposure Routes/Pathways	6.9E-03

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.7a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF FUTURE CHILD RESIDENTS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	8.1E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.0E-05	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.5E-05	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	6.0E-06	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	9.4E-06	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.2E-06	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	3.7E-06	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	6.2E-02	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	6.2E-02
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	1.1E-04	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	2.7E-01
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	4.7E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.6E-01
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	1.5E-03	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	7.7E-03
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	4.4E-04	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	1.1E-02
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	1.6E-01	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	2.3E-01
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	3.9E-03	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.9E-01
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	1.2E-06	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	1.7E-02
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.9E-04	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	1.9E-01
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	9.6E-04	mg/kg-day		mg/kg-day	NA	NA	
	(total)												1.1E+00
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.2E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.5E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	2.2E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	8.7E-07	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.4E-06	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.8E-07	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	5.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.6E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	5.3E-03
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												5.3E-03
												Total Hazard Index Across All Exposure Routes/Pathways	1.1E+00

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.8a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS FROM EXPOSURE OF FUTURE ADULT RESIDENTS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	8.7E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.1E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.6E-06	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	6.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.0E-06	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.3E-07	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	3.9E-07	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	6.6E-03	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	6.6E-03
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	1.2E-05	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	2.9E-02
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	5.0E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.7E-02
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	1.7E-04	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	8.3E-04
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	4.7E-05	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	1.2E-03
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	1.7E-02	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	2.5E-02
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	4.1E-04	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	2.1E-02
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	1.3E-07	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	1.8E-03
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	2.1E-05	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	2.1E-02
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	1.0E-04	mg/kg-day		mg/kg-day	NA	NA	
	(total)												1.2E-01
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.3E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.6E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	2.4E-07	mg/kg-day		mg/kg-day	NA	NA	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	9.5E-08	mg/kg-day		mg/kg-day	NA	NA	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.5E-07	mg/kg-day		mg/kg-day	NA	NA	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.0E-08	mg/kg-day		mg/kg-day	NA	NA	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	5.8E-08	mg/kg-day		mg/kg-day	NA	NA	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	0.0E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	0.0E+00	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.7E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	5.7E-04
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	0.0E+00	mg/kg-day	1.4E-02	mg/kg-day	NA	NA	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	0.0E+00	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	0.0E+00	mg/kg-day	7.0E-01	mg/kg-day	NA	NA	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	0.0E+00	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	0.0E+00	mg/kg-day	7.0E-05	mg/kg-day	NA	NA	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	0.0E+00	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	0.0E+00	mg/kg-day		mg/kg-day	NA	NA	
	(total)												5.7E-04
												Total Hazard Index Across All Exposure Routes/Pathways	**1.2E-01**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 7.9a. CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF NON-CANCER HAZARDS
EXPOSURE OF CONSTRUCTION/EXCAVATION WORKERS BY INHALATION FROM SURFACE SOIL
UXO 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction/Excavation Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	*Barium*	3.61E+02	mg/kg	2.40E-04	mg/m^3	R	2.8E-05	mg/kg-day	1.40E-04	mg/kg-day	4.90E-04	mg/m^3	2.0E-01
	Chromium	3.09E+01	mg/kg	2.06E-05	mg/m^3	R	2.4E-06	mg/kg-day	3.00E-05	mg/kg-day	1.05E-04	mg/m^3	8.1E-02
	Manganese	9.03E+02	mg/kg	6.01E-04	mg/m^3	R	7.1E-05	mg/kg-day	1.40E-05	mg/kg-day	4.9E-05	mg/m^3	5.0E+00
	(total)												5.3E+00
												Total Hazard Index Across All Exposure Routes/Pathways	**5.3E+00**

TABLE 8.1 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	5.3E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	3.8E-08
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	6.6E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	4.8E-07
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.0E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	7.3E-08
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.9E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	2.8E-09
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	6.1E-08	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	4.4E-10
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	8.0E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	5.9E-08
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.4E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.7E-08
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	4.0E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	7.1E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	3.0E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.6E-07
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	1.0E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	2.8E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	1.1E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	2.5E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	7.7E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.2E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	6.2E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.1E-06**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.1E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.5E-08
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.6E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.9E-07
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	3.9E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	2.8E-08
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.5E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	1.1E-09
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.4E-08	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	1.7E-10
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	3.1E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	2.3E-08
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	9.3E-09	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	6.8E-09
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.7E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.1E-08
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**3.0E-07**
										Total Risk Across All Exposure Routes/Pathways	**1.4E-06**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.2 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF MAINTENANCE WORKERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Maintenance Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	6.4E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	4.7E-08
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	8.1E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	5.9E-07
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.2E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	8.8E-08
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	4.7E-08	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	3.4E-09
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	7.4E-08	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	5.4E-10
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	9.7E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	7.1E-08
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.9E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2.1E-08
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	4.9E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	8.6E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	3.7E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	5.5E-07
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	1.2E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	3.4E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	1.3E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	3.0E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	9.4E-09	mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.5E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	7.5E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**1.4E-06**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.1E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.5E-08
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.6E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.9E-07
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	3.9E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2.8E-08
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.5E-08	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	1.1E-09
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.4E-08	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	1.7E-10
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	3.1E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	2.3E-08
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	9.3E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	6.8E-09
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.7E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	4.1E-08
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**3.0E-07**
										Total Risk Across All Exposure Routes/Pathways	**1.7E-06**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 *Arsenic - 0.03*

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.3 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF OCCUPATIONAL WORKERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	6.6E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	4.8E-07
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	8.4E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	6.1E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.3E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	9.2E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	4.9E-07	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	3.6E-08
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	7.7E-07	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	5.6E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.0E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	7.4E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	3.0E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	2.2E-07
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	5.1E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	8.9E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	3.8E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	5.8E-06
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	1.3E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	3.6E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	1.3E-02	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	3.2E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	9.8E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.6E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	7.9E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.4E-05**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	5.7E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	4.2E-07
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	7.2E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	5.3E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.1E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	7.9E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	4.2E-07	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	3.1E-08
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	6.6E-07	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	4.8E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	8.7E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	6.3E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.6E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.9E-07
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	7.6E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.1E-06
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**8.5E-06**
										Total Risk Across All Exposure Routes/Pathways	**2.3E-05**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.4 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADOLESCENT TRESPASSERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (age 6 - 17)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	4.9E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.1E-07
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	6.2E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.4E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	9.4E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	2.1E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.6E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	8.0E-09
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	5.7E-08	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	1.3E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	7.5E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.7E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.2E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	4.9E-08
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	3.8E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	6.6E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.9E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.3E-07
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	9.4E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	2.7E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	9.9E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	2.4E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	7.3E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.2E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	5.9E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**2.3E-06**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	4.2E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	9.2E-08
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	5.3E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.2E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	8.0E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.8E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.1E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	6.8E-09
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	4.9E-08	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	1.1E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	6.4E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.4E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.9E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	4.2E-08
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	5.6E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	8.5E-08
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.7E-06**
										Total Risk Across All Exposure Routes/Pathways	**4.0E-06**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.5 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CHILD RECREATIONAL USERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	5.2E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	3.8E-07
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	6.5E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	4.8E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	9.8E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	7.1E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.8E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	2.8E-08
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	6.0E-08	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	4.4E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	7.9E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	5.7E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.3E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.7E-07
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	3.9E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	6.9E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	3.0E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.5E-07
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	9.8E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	2.8E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	1.0E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	2.5E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	7.6E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.2E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	6.1E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**7.1E-06**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	4.4E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	3.2E-07
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	5.6E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	4.1E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	8.4E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	6.1E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.3E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	2.4E-08
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	5.1E-08	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	3.7E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	6.8E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	4.9E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.0E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.5E-07
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	5.9E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	8.9E-08
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**5.8E-06**
										Total Risk Across All Exposure Routes/Pathways	**1.3E-05**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.5 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CHILD RECREATIONAL USERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk *Calculation (1)*	Intake (Cancer)	Intake (Cancer) *Units*	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	5.2E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	6.0E-07
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	6.5E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	7.6E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	9.8E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.1E-06
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.8E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	4.4E-08
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	6.0E-08	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	7.0E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	7.9E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	9.2E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.3E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	2.7E-07
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	3.9E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	6.9E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	3.0E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.3E-06
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	9.8E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	2.8E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	1.0E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	2.5E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	7.6E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.2E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	6.1E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.2E-05**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	4.4E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	5.2E-07
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	5.6E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	6.5E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	8.4E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	9.8E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.3E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	3.8E-08
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	5.1E-08	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	6.0E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	6.8E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	7.9E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.0E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	2.3E-07
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	5.9E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.7E-07
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**9.4E-06**
										Total Risk Across All Exposure Routes/Pathways	**2.1E-05**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

<u>Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):</u>

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.6 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADULT RECREATIONAL USERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational User
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.8E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	6.0E-08
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	3.5E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	7.6E-07
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	5.2E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.1E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	2.0E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	4.5E-09
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	3.2E-08	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	7.0E-10
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	4.2E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	9.2E-08
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.3E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	2.7E-08
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	2.1E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	3.7E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.6E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.4E-07
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	5.2E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	1.5E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	5.5E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	1.3E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	4.1E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	6.6E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	3.3E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.3E-06**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	4.6E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.0E-07
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	5.8E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.3E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	8.6E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.9E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.4E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	7.4E-09
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	5.3E-08	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	1.2E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	7.0E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.5E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.1E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	4.5E-08
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	6.1E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	9.1E-08
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.8E-06**
										Total Risk Across All Exposure Routes/Pathways	**3.2E-06**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

<u>Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):</u>

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.6 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADULT RECREATIONAL USERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational User
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.8E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	8.9E-08
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	3.5E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.1E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	5.2E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.7E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	2.0E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	6.5E-09
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	3.2E-08	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	1.0E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	4.2E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.4E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.3E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	4.0E-08
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	2.1E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	3.7E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.6E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	5.8E-07
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	5.2E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	1.5E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	5.5E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	1.3E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	4.1E-09	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	6.6E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	3.3E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**2.1E-06**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	4.6E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.5E-07
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	5.8E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.8E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	8.6E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	2.8E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.4E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	1.1E-08
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	5.3E-08	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	1.7E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	7.0E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	2.2E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.1E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	6.6E-08
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	6.1E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.2E-07
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**2.8E-06**
										Total Risk Across All Exposure Routes/Pathways	**4.9E-06**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.7 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF FUTURE CHILD RESIDENTS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	6.9E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	5.1E-06
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	8.8E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	6.4E-05
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.3E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	9.6E-06
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	5.1E-07	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	3.7E-07
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	8.0E-07	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	5.9E-08
	Dibenzo(a,h)anthracene	*2.90E-01*	*mg/kg*	2.90E-01	*mg/kg*	M	1.1E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	7.7E-06
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	3.1E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	2.3E-06
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	5.3E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	9.3E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	4.0E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	1.3E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	3.7E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	1.4E-02	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	3.3E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	1.0E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.6E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	8.2E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**8.9E-05**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.5E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.8E-06
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	3.2E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	2.3E-05
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	4.8E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	3.5E-06
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.9E-07	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	1.4E-07
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.9E-07	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	2.1E-08
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	3.9E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	2.8E-06
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.1E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	8.3E-07
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	3.4E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**3.2E-05**
										Total Risk Across All Exposure Routes/Pathways	**1.2E-04**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.7 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF FUTURE CHILD RESIDENTS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.4E-06	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	3.0E-06
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.8E-06	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	3.8E-05
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	2.6E-06	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	5.8E-06
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.0E-06	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	2.2E-07
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.6E-06	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	3.5E-08
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.1E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	4.6E-06
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	6.3E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.4E-06
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	1.1E-02	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	1.9E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	8.0E-06	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	2.6E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	7.5E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	2.8E-02	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	6.6E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	2.0E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	3.3E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	1.6E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**5.3E-05**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	5.1E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.1E-06
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	6.4E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.4E-05
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	9.6E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2.1E-06
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.7E-07	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	8.2E-08
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	5.9E-07	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	1.3E-08
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	7.7E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.7E-06
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.3E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	5.0E-07
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	6.8E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**1.9E-05**
									Total Risk Across All Exposure Routes/Pathways		**7.3E-05**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.7 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF FUTURE CHILD RESIDENTS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.1E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.6E-06	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	3.9E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.5E-06	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.4E-06	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	3.2E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	9.4E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	1.6E-02	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	2.8E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.2E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.8E-05
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	4.0E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	1.1E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	4.2E-02	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	9.9E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	3.1E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	4.9E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	2.5E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.8E-05**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	7.6E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	9.6E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.4E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	5.6E-07	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	8.8E-07	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.2E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	3.4E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.0E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.5E-06
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**1.5E-06**
										Total Risk Across All Exposure Routes/Pathways	**2.0E-05**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.8 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF FUTURE ADULT RESIDENTS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	3.7E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	8.1E-07
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	4.7E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.0E-05
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	7.0E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.5E-06
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	2.7E-07	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	6.0E-08
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	4.3E-07	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	9.4E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	5.7E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.2E-06
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.7E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	3.7E-07
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	2.8E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	5.0E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.2E-06	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	7.1E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	2.0E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	7.4E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	1.8E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	5.5E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	8.8E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	4.4E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**1.4E-05**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.9E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	4.2E-07
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.4E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	5.3E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	3.7E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	8.0E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.4E-07	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	3.1E-08
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.2E-07	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	4.9E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.9E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	6.4E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	8.7E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.9E-07
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.6E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**7.4E-06**
										Total Risk Across All Exposure Routes/Pathways	**2.2E-05**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.8 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF FUTURE ADULT RESIDENTS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	5.2E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	3.8E-07
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	6.6E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	4.8E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	9.9E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	7.2E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.8E-07	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	2.8E-08
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	6.0E-07	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	4.4E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	7.9E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	5.8E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.4E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.7E-07
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	4.0E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	7.0E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	3.0E-06	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	9.9E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	2.8E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	1.0E-02	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	2.5E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	7.7E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.2E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	6.2E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**6.7E-06**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.7E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2.0E-07
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	3.4E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	2.5E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	5.1E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	3.7E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	2.0E-07	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	1.5E-08
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	3.1E-07	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	2.3E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	4.1E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	3.0E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.2E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	8.9E-08
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	3.6E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**3.5E-06**
										Total Risk Across All Exposure Routes/Pathways	**1.0E-05**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 *Arsenic - 0.03*

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.8 - REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF FUTURE ADULT RESIDENTS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	8.9E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.1E-06	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.7E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	6.6E-07	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.0E-06	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.4E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	4.0E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	6.8E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	1.2E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	5.2E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	7.7E-06
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	1.7E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	4.8E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	1.8E-02	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	4.2E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	1.3E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	2.1E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	1.1E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**7.7E-06**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	4.6E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	5.8E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	8.8E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.4E-07	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	5.4E-07	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	7.1E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.1E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	6.2E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	9.3E-07
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**9.3E-07**
										Total Risk Across All Exposure Routes/Pathways	**8.7E-06**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

8.9. REASONABLE MAXIMUM EXPOSURE (RME)
CALCULATION OF CANCER RISKS
EXPOSURE OF CONSTRUCTION/EXCAVATION WORKERS BY INHALATION FROM SURFACE SOIL
UXO 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction/Excavation Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	Barium	3.61E+02	mg/kg	2.40E-04	mg/m^3	R	4.0E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Chromium	3.09E+01	mg/kg	2.06E-05	mg/m^3	R	3.5E-08	mg/kg-day	4.20E+01	$(mg/kg\text{-}day)^{-1}$	1.4E-06
	Manganese	9.03E+02	mg/kg	6.01E-04	mg/m^3	R	1.0E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										1.4E-06
										Total Risk Across All Exposure Routes/Pathways	**1.4E-06**

TABLE 8.1a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CONSTRUCTION WORKERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.6E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.9E-08
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	3.3E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	2.4E-07
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	5.0E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	3.6E-08
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.9E-08	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	1.4E-09
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	3.0E-08	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	2.2E-10
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	4.0E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	2.9E-08
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.2E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	8.7E-09
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	2.0E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	3.5E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.5E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	2.3E-07
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	5.0E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	1.4E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	5.3E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	1.2E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	3.9E-09	mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	6.2E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	3.1E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										5.7E-07
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	6.8E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	5.0E-09
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	8.6E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	6.3E-08
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.3E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	9.5E-09
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	5.0E-09	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	3.7E-10
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	7.9E-09	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	5.8E-11
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.0E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	7.6E-09
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	3.1E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2.3E-09
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	9.1E-09	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	1.4E-08
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										1.0E-07
										Total Risk Across All Exposure Routes/Pathways	6.7E-07

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.2a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF MAINTENANCE WORKERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Maintenance Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	5.7E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	4.2E-09
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	7.2E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	5.3E-08
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.1E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	7.9E-09
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	4.2E-09	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	3.1E-10
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	6.6E-09	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	4.8E-11
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	8.8E-10	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	6.4E-09
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.6E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.9E-09
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	4.4E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	7.7E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	3.3E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	5.0E-08
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	1.1E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	3.1E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	1.1E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	2.7E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	8.5E-10	mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.4E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	6.8E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**1.2E-07**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	6.8E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	5.0E-09
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	8.6E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	6.3E-08
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.3E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	9.5E-09
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	5.0E-09	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	3.7E-10
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	7.9E-09	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	5.8E-11
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.0E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	7.6E-09
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	3.1E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2.3E-09
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	9.1E-09	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	1.4E-08
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**1.0E-07**
										Total Risk Across All Exposure Routes/Pathways	**2.2E-07**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.3a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF OCCUPATIONAL WORKERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Occupational Worker
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.0E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	7.6E-08
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.3E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	9.7E-07
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	2.0E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.4E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	7.7E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	5.6E-09
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.2E-07	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	8.8E-10
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.6E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.2E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	4.7E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	3.5E-08
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	8.0E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	1.4E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	6.1E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	9.1E-07
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	2.0E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	5.6E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	2.1E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	5.0E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	1.5E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	2.5E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	1.2E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										2.3E-06
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.8E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.3E-08
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.3E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.7E-07
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	3.4E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	2.5E-08
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.3E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	9.7E-10
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.1E-08	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	1.5E-10
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.7E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	2.0E-08
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	8.1E-09	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	5.9E-09
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.4E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	3.6E-08
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										2.7E-07
										Total Risk Across All Exposure Routes/Pathways	**2.5E-06**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.4a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADOLESCENT TRESPASSERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Trespasser
Receptor Age: Adolescent (age 6 - 17)

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.2E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	9.0E-09
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.6E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.1E-07
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	2.3E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.7E-08
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	9.1E-09	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	6.7E-10
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.4E-08	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	1.0E-10
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.9E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.4E-08
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	5.6E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	4.1E-09
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	9.4E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	1.7E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	7.2E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	1.1E-07
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	2.3E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	6.6E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	2.5E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	5.9E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	1.8E-09	mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	2.9E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	1.5E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**2.7E-07**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	4.0E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2.9E-09
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	5.0E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	3.7E-08
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	7.6E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	5.5E-09
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	2.9E-09	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	2.1E-10
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	4.6E-09	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	3.4E-11
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	6.1E-10	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	4.4E-09
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.8E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.3E-09
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	5.3E-09	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	8.0E-09
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**5.9E-08**
										Total Risk Across All Exposure Routes/Pathways	**3.3E-07**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13   Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.5a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF CHILD RECREATIONAL USERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational User
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.3E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	9.4E-09
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.6E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.2E-07
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	2.4E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.8E-08
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	9.5E-09	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	6.9E-10
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.5E-08	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	1.1E-10
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.0E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.4E-08
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	5.8E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	4.3E-09
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	9.8E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	1.7E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	7.5E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	1.1E-07
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	2.4E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	6.9E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	2.6E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	6.1E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	1.9E-09	mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	3.1E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	1.5E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**2.8E-07**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	4.4E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	3.2E-09
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	5.6E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	4.1E-08
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	8.4E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	6.1E-09
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.3E-09	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	2.4E-10
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	5.1E-09	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	3.7E-11
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	6.8E-10	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	4.9E-09
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.0E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.5E-09
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	5.9E-09	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	8.9E-09
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**6.6E-08**
										Total Risk Across All Exposure Routes/Pathways	**3.4E-07**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.6a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF ADULT RECREATIONAL USERS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Recreational User
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	4.8E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	3.5E-09
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	6.1E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	4.5E-08
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	9.2E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	6.7E-09
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	3.6E-09	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	2.6E-10
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	5.6E-09	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	4.1E-11
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	7.4E-10	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	5.4E-09
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	2.2E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.6E-09
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	3.7E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	6.5E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	2.8E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	4.2E-08
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	9.2E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	2.6E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	9.7E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	2.3E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	7.1E-10	mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	1.1E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	5.7E-07	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**1.0E-07**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.3E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.7E-09
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.9E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	2.1E-08
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	4.3E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	3.2E-09
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.7E-09	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	1.2E-10
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.6E-09	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	1.9E-11
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	3.5E-10	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	2.5E-09
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.0E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	7.5E-10
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	3.0E-09	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	4.6E-09
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**3.4E-08**
										Total Risk Across All Exposure Routes/Pathways	**1.4E-07**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.7a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF FUTURE CHILD RESIDENTS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Child

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	2.3E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.7E-07
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	2.9E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	2.1E-06
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	4.4E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	3.2E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	1.7E-07	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	1.2E-08
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	2.7E-07	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	2.0E-09
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	3.5E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	2.6E-07
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.1E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	7.7E-08
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	1.8E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	3.1E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.3E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.0E-06
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	4.4E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	1.2E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	4.6E-03	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	1.1E-04	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	3.4E-08	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	5.5E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	2.7E-05	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**5.0E-06**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	3.4E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	2.5E-08
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	4.3E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	3.1E-07
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	6.4E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	4.7E-08
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	2.5E-08	mg/kg-day	7.3E-02	$(mg/kg\text{-}day)^{-1}$	1.8E-09
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	3.9E-08	mg/kg-day	7.3E-03	$(mg/kg\text{-}day)^{-1}$	2.9E-10
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	5.2E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	3.8E-08
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	1.5E-08	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.1E-08
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	4.5E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	6.8E-08
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										**5.0E-07**
										Total Risk Across All Exposure Routes/Pathways	**5.5E-06**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - *0.13*   *Arsenic - 0.03*

Other Metals - not evaluated for dermal contact with soil or sediment

TABLE 8.8a - CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS FROM EXPOSURE OF FUTURE ADULT RESIDENTS TO SURFACE SOIL
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Entire Site
Receptor Population: Residents
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	8.7E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	6.4E-08
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.1E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	8.0E-07
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	1.6E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.2E-07
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	6.4E-08	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	4.7E-09
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.0E-07	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	7.4E-10
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	1.3E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	9.7E-08
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	3.9E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2.9E-08
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M	6.6E-04	mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M	1.2E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	5.0E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	7.6E-07
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M	1.7E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M	4.7E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M	1.7E-03	mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M	4.1E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M	1.3E-08	mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M	2.1E-06	mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M	1.0E-05	mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**1.9E-06**
Dermal	Benzo(a)anthracene	1.90E+00	mg/kg	1.90E+00	mg/kg	M	1.3E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	9.4E-09
	Benzo(a)pyrene	2.40E+00	mg/kg	2.40E+00	mg/kg	M	1.6E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.2E-07
	Benzo(b)fluoranthene	3.60E+00	mg/kg	3.60E+00	mg/kg	M	2.4E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.8E-08
	Benzo(k)fluoranthene	1.40E+00	mg/kg	1.40E+00	mg/kg	M	9.5E-09	mg/kg-day	7.3E-02	(mg/kg-day)$^{-1}$	6.9E-10
	Chrysene	2.20E+00	mg/kg	2.20E+00	mg/kg	M	1.5E-08	mg/kg-day	7.3E-03	(mg/kg-day)$^{-1}$	1.1E-10
	Dibenzo(a,h)anthracene	2.90E-01	mg/kg	2.90E-01	mg/kg	M	2.0E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.4E-08
	Indeno(1,2,3-cd)pyrene	8.60E-01	mg/kg	8.60E-01	mg/kg	M	5.8E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	4.3E-09
	Aluminum	1.45E+04	mg/kg	1.45E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Antimony	2.55E+01	mg/kg	2.55E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Arsenic	1.10E+01	mg/kg	1.10E+01	mg/kg	M	1.7E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	2.6E-08
	Barium	3.61E+02	mg/kg	3.61E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Copper	1.02E+02	mg/kg	1.02E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Iron	3.80E+04	mg/kg	3.80E+04	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Manganese	9.03E+02	mg/kg	9.03E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Thallium	2.80E-01	mg/kg	2.80E-01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Vanadium	4.51E+01	mg/kg	4.51E+01	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	Lead	2.25E+02	mg/kg	2.25E+02	mg/kg	M		mg/kg-day		(mg/kg-day)$^{-1}$	
	(total)										**1.9E-07**
										Total Risk Across All Exposure Routes/Pathways	**2.1E-06**

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

Dermal Absorption Fraction from Soil(ABS) (USEPA, July 2004):

PAHs - 0.13 Arsenic - 0.03

Other Metals - not evaluated for dermal contact with soil or sediment

8.9a. CENTRAL TENDENCY EXPOSURE (CTE)
CALCULATION OF CANCER RISKS
EXPOSURE OF CONSTRUCTION/EXCAVATION WORKERS BY INHALATION FROM SURFACE SOIL
UXO 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Entire Site
Receptor Population: Construction/Excavation Workers
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	Barium	3.61E+02	mg/kg	2.40E-04	mg/m^3	R	4.0E-07	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	Chromium	3.09E+01	mg/kg	2.06E-05	mg/m^3	R	3.5E-08	mg/kg-day	4.20E+01	$(mg/kg\text{-}day)^{-1}$	1.4E-06
	Manganese	9.03E+02	mg/kg	6.01E-04	mg/m^3	R	1.0E-06	mg/kg-day		$(mg/kg\text{-}day)^{-1}$	
	(total)										1.4E-06
										Total Risk Across All Exposure Routes/Pathways	**1.4E-06**

TABLE 9.1. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - CONSTRUCTION/EXCAVATION WORKERS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Construction/Excavation Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	3.8E-08		1.5E-08	5.3E-08	Benzo(a)anthracene					
			Benzo(a)pyrene	4.8E-07		1.9E-07	6.7E-07	Benzo(a)pyrene					
			Benzo(b)fluoranthene	7.3E-08		2.8E-08	1.0E-07	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	2.8E-09		1.1E-09	3.9E-09	Benzo(k)fluoranthene					
			Chrysene	4.4E-10		1.7E-10	6.2E-10	Chrysene					
			Dibenzo(a,h)anthracene	5.9E-08		2.3E-08	8.1E-08	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	1.7E-08		6.8E-09	2.4E-08	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	2.8E-02			2.8E-02
			Antimony					Antimony	Blood	1.2E-01			1.2E-01
			Arsenic	4.6E-07		4.1E-08	5.0E-07	Arsenic	Skin, CVS	7.1E-02		6.4E-03	7.7E-02
			Barium					Barium	Kidney	3.5E-03	2.0E-01		2.1E-01
			Copper					Copper	GS	4.9E-03			4.9E-03
			Chromium		1.4E-06		1.4E-06	Chromium	Fetotoxicity/GS/Bone		8.1E-02		8.1E-02
			Iron					Iron	NA	1.1E-01			1.1E-01
			Manganese					Manganese	CNS	8.7E-02	5.0E+00		5.1E+00
			Thallium					Thallium	Liver	7.7E-03			7.7E-03
			Vanadium					Vanadium	Kidney	8.7E-02			8.7E-02
			Total Risk Across Surface Soil				2.9E-06		Total Hazard Index Across Surface Soil				5.9E+00

Target Organ Analysis

Total CNS HI =	5.E+00	Total GS HI =	9.E-02
Total Blood HI =	1.E-01	Total Liver HI =	8.E-03
Total CVS HI =	8.E-02	Total Kidney HI =	3.E-01
Total Skin HI =	8.E-02	Total Bone HI =	8.E-02
Total Fetotoxicity HI =	8.E-02		

TABLE 9.2. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - MAINTENANCE WORKERS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Maintenance Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	4.7E-08		1.5E-08	6.2E-08	Benzo(a)anthracene					
			Benzo(a)pyrene	5.9E-07		1.9E-07	7.8E-07	Benzo(a)pyrene					
			Benzo(b)fluoranthene	8.8E-08		2.8E-08	1.2E-07	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	3.4E-09		1.1E-09	4.5E-09	Benzo(k)fluoranthene					
			Chrysene	5.4E-10		1.7E-10	7.1E-10	Chrysene					
			Dibenzo(a,h)anthracene	7.1E-08		2.3E-08	9.4E-08	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	2.1E-08		6.8E-09	2.8E-08	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	1.4E-03			1.4E-03
			Antimony					Antimony	Blood	6.0E-03			6.0E-03
			Arsenic	5.5E-07		4.1E-08	5.9E-07	Arsenic	Skin, CVS	3.4E-03		6.8E-04	4.1E-03
			Barium					Barium	Kidney	1.7E-04			1.7E-04
			Copper					Copper	GS	2.4E-04			2.4E-04
			Iron					Iron	NA	5.1E-03			5.1E-03
			Manganese					Manganese	CNS	4.2E-03			4.2E-03
			Thallium					Thallium	Liver	3.8E-04			3.8E-04
			Vanadium					Vanadium	Kidney	4.2E-03			4.2E-03
			Total Risk Across Surface Soil				1.7E-06			Total Hazard Index Across Surface Soil			2.6E-02

Target Organ Analysis

Total CNS HI =	6.E-03
Total Blood HI =	6.E-03
Total CVS HI =	4.E-03
Total Skin HI =	4.E-03
Total GS HI =	2.E-04
Total Liver HI =	4.E-04
Total Kidney HI =	4.E-03

TABLE 9.3. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - OCCUPATIONAL WORKERS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Occupational Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	4.8E-07		4.2E-07	9.0E-07	Benzo(a)anthracene					
			Benzo(a)pyrene	6.1E-06		5.3E-06	1.1E-05	Benzo(a)pyrene					
			Benzo(b)fluoranthene	9.2E-07		7.9E-07	1.7E-06	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	3.6E-08		3.1E-08	6.6E-08	Benzo(k)fluoranthene					
			Chrysene	5.6E-09		4.8E-09	1.0E-08	Chrysene					
			Dibenzo(a,h)anthracene	7.4E-07		6.3E-07	1.4E-06	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	2.2E-07		1.9E-07	4.1E-07	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	1.4E-02			1.4E-02
			Antimony					Antimony	Blood	6.2E-02			6.2E-02
			Arsenic	5.8E-06		1.1E-06	6.9E-06	Arsenic	Skin, CVS	3.6E-02		7.1E-03	4.3E-02
			Barium					Barium	Kidney	1.8E-03			1.8E-03
			Copper					Copper	GS	2.5E-03			2.5E-03
			Iron					Iron	NA	5.3E-02			5.3E-02
			Manganese					Manganese	CNS	4.4E-02			4.4E-02
			Thallium					Thallium	Liver	3.9E-03			3.9E-03
			Vanadium					Vanadium	Kidney	4.4E-02			4.4E-02
			Total Risk Across Surface Soil				2.3E-05			Total Hazard Index Across Surface Soil			2.7E-01

Target Organ Analysis

Total CNS HI =	6.E-02	Total GS HI =	2.E-03
Total Blood HI =	6.E-02	Total Liver HI =	4.E-03
Total CVS HI =	4.E-02	Total Kidney HI =	5.E-02
Total Skin HI =	4.E-02		

TABLE 9.4. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - ASOLESCENT TRESPASSERS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Trespassers
Receptor Age: Adolescent (age 6 - 17)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	1.1E-07		9.2E-08	2.0E-07	Benzo(a)anthracene					
			Benzo(a)pyrene	1.4E-06		1.2E-06	2.5E-06	Benzo(a)pyrene					
			Benzo(b)fluoranthene	2.1E-07		1.8E-07	3.8E-07	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	8.0E-09		6.8E-09	1.5E-08	Benzo(k)fluoranthene					
			Chrysene	1.3E-09		1.1E-09	2.3E-09	Chrysene					
			Dibenzo(a,h)anthracene	1.7E-07		1.4E-07	3.1E-07	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	4.9E-08		4.2E-08	9.1E-08	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	2.4E-03			2.4E-03
			Antimony					Antimony	Blood	1.1E-02			1.1E-02
			Arsenic	4.3E-07		8.5E-08	5.1E-07	Arsenic	Skin, CVS	6.1E-03		1.2E-03	7.3E-03
			Barium					Barium	Kidney	3.0E-04			3.0E-04
			Copper					Copper	GS	4.2E-04			4.2E-04
			Iron					Iron	NA	9.0E-03			9.0E-03
			Manganese					Manganese	CNS	7.5E-03			7.5E-03
			Thallium					Thallium	Liver	6.6E-04			6.6E-04
			Vanadium					Vanadium	Kidney	7.5E-03			7.5E-03
					Total Risk Across Surface Soil		4.0E-06			Total Hazard Index Across Surface Soil			4.6E-02

Target Organ Analysis

Total CNS HI =	1.E-02	Total GS HI =	4.E-04
Total Blood HI =	1.E-02	Total Liver HI =	7.E-04
Total CVS HI =	7.E-03	Total Kidney HI =	8.E-03
Total Skin HI =	7.E-03		

TABLE 9.5. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - CHILD RECREATIONAL USERS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Recreational Users
Receptor Age: Child (0 to 6 years)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	6.0E-07		5.2E-07	1.1E-06	Benzo(a)anthracene					
			Benzo(a)pyrene	7.6E-06		6.5E-06	1.4E-05	Benzo(a)pyrene					
			Benzo(b)fluoranthene	1.1E-06		9.8E-07	2.1E-06	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	4.4E-08		3.8E-08	8.2E-08	Benzo(k)fluoranthene					
			Chrysene	7.0E-09		6.0E-09	1.3E-08	Chrysene					
			Dibenzo(a,h)anthracene	9.2E-07		7.9E-07	1.7E-06	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	2.7E-07		2.3E-07	5.1E-07	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	1.4E-02			1.4E-02
			Antimony					Antimony	Blood	6.1E-02			6.1E-02
			Arsenic	1.3E-06		2.7E-07	1.6E-06	Arsenic	Skin, CVS	3.5E-02		6.9E-03	4.2E-02
			Barium					Barium	Kidney	1.7E-03			1.7E-03
			Copper					Copper	GS	2.4E-03			2.4E-03
			Iron					Iron	NA	5.2E-02			5.2E-02
			Manganese					Manganese	CNS	4.3E-02			4.3E-02
			Thallium					Thallium	Liver	3.8E-03			3.8E-03
			Vanadium					Vanadium	Kidney	4.3E-02			4.3E-02
			Total Risk Across Surface Soil				2.1E-05		Total Hazard Index Across Surface Soil				2.6E-01

Target Organ Analysis

Total CNS HI =	6.E-02	Total GS HI =	2.E-03
Total Blood HI =	6.E-02	Total Liver HI =	4.E-03
Total CVS HI =	4.E-02	Total Kidney HI =	4.E-02
Total Skin HI =	4.E-02		

TABLE 9.6. REASONABLE MAXIMUM EXPOSURE (RME)

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - ADULT RECREATIONAL USERS

UXO NO. 7

NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Recreational Users
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	8.9E-08		1.5E-07	2.4E-07	Benzo(a)anthracene					
			Benzo(a)pyrene	1.1E-06		1.8E-06	3.0E-06	Benzo(a)pyrene					
			Benzo(b)fluoranthene	1.7E-07		2.8E-07	4.5E-07	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	6.5E-09		1.1E-08	1.7E-08	Benzo(k)fluoranthene					
			Chrysene	1.0E-09		1.7E-09	2.7E-09	Chrysene					
			Dibenzo(a,h)anthracene	1.4E-07		2.2E-07	3.6E-07	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	4.0E-08		6.6E-08	1.1E-07	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	1.5E-03			1.5E-03
			Antimony					Antimony	Blood	6.5E-03			6.5E-03
			Arsenic	5.8E-07		2.2E-07	7.9E-07	Arsenic	Skin, CVS	3.7E-03		1.4E-03	5.2E-03
			Barium					Barium	Kidney	1.8E-04			1.8E-04
			Copper					Copper	GS	2.6E-04			2.6E-04
			Iron					Iron	NA	5.5E-03			5.5E-03
			Manganese					Manganese	CNS	4.6E-03			4.6E-03
			Thallium					Thallium	Liver	4.1E-04			4.1E-04
			Vanadium					Vanadium	Kidney	4.6E-03			4.6E-03
			Total Risk Across Surface Soil				4.9E-06			Total Hazard Index Across Surface Soil			2.9E-02

Target Organ Analysis

Total CNS HI =	6.E-03	Total GS HI =	3.E-04
Total Blood HI =	6.E-03	Total Liver HI =	4.E-04
Total CVS HI =	5.E-03	Total Kidney HI =	5.E-03
Total Skin HI =	5.E-03		

TABLE 9.7. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - TOTAL RECREATIONAL ILCRS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe:	Future
Receptor Population:	Recreational Users
Receptor Age:	Child + Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	6.9E-07		6.6E-07	1.4E-06
			Benzo(a)pyrene	8.7E-06		8.4E-06	1.7E-05
			Benzo(b)fluoranthene	1.3E-06		1.3E-06	2.6E-06
			Benzo(k)fluoranthene	5.1E-08		4.9E-08	1.0E-07
			Chrysene	8.0E-09		7.7E-09	1.6E-08
			Dibenzo(a,h)anthracene	1.1E-06		1.0E-06	2.1E-06
			Indeno(1,2,3-cd)pyrene	3.1E-07		3.0E-07	6.1E-07
			Aluminum				
			Antimony				
			Arsenic	1.9E-06		4.9E-07	2.4E-06
			Barium				
			Copper				
			Iron				
			Manganese				
			Thallium				
			Vanadium				
			Total Risk Across Surface Soil				2.6E-05

TABLE 9.8. REASONABLE MAXIMUM EXPOSURE (RME)

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - FUTURE CHILD RESIDENT

UXO NO. 7

NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child (0 to 6 years)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	8.1E-06		3.0E-06	1.1E-05	Benzo(a)anthracene					
			Benzo(a)pyrene	1.0E-04		3.7E-05	1.4E-04	Benzo(a)pyrene					
			Benzo(b)fluoranthene	1.5E-05		5.6E-06	2.1E-05	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	6.0E-07		2.2E-07	8.1E-07	Benzo(k)fluoranthene					
			Chrysene	9.4E-08		3.4E-08	1.3E-07	Chrysene					
			Dibenzo(a,h)anthracene	1.2E-05		4.5E-06	1.7E-05	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	3.7E-06		1.3E-06	5.0E-06	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	1.9E-01			1.9E-01
			Antimony					Antimony	Blood	8.2E-01			8.2E-01
			Arsenic	1.8E-05		1.5E-06	2.0E-05	Arsenic	Skin, CVS	4.7E-01		3.9E-02	5.1E-01
			Barium					Barium	Kidney	2.3E-02			2.3E-02
			Copper					Copper	GS	3.3E-02			3.3E-02
			Iron					Iron	NA	6.9E-01			6.9E-01
			Manganese					Manganese	CNS	5.8E-01			5.8E-01
			Thallium					Thallium	Liver	5.1E-02			5.1E-02
			Vanadium					Vanadium	Kidney	5.8E-01			5.8E-01
			Total Risk Across Surface Soil				2.1E-04			Total Hazard Index Across Surface Soil			3.5E+00

Target Organ Analysis

Total CNS HI =	8.E-01	Total GS HI =	3.E-02
Total Blood HI =	8.E-01	Total Liver HI =	5.E-02
Total CVS HI =	5.E-01	Total Kidney HI =	6.E-01
Total Skin HI =	5.E-01		

TABLE 9.9. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - FUTURE ADULT RESIDENT
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	1.2E-06		6.2E-07	1.8E-06	Benzo(a)anthracene					
			Benzo(a)pyrene	1.5E-05		7.8E-06	2.3E-05	Benzo(a)pyrene					
			Benzo(b)fluoranthene	2.3E-06		1.2E-06	3.4E-06	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	8.8E-08		4.6E-08	1.3E-07	Benzo(k)fluoranthene					
			Chrysene	1.4E-08		7.2E-09	2.1E-08	Chrysene					
			Dibenzo(a,h)anthracene	1.8E-06		9.5E-07	2.8E-06	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	5.4E-07		2.8E-07	8.2E-07	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	2.0E-02			2.0E-02
			Antimony					Antimony	Blood	8.7E-02			8.7E-02
			Arsenic	7.7E-06		9.3E-07	8.7E-06	Arsenic	Skin, CVS	5.0E-02		6.0E-03	5.6E-02
			Barium					Barium	Kidney	2.5E-03			2.5E-03
			Copper					Copper	GS	3.5E-03			3.5E-03
			Iron					Iron	NA	7.4E-02			7.4E-02
			Manganese					Manganese	CNS	6.2E-02			6.2E-02
			Thallium					Thallium	Liver	5.5E-03			5.5E-03
			Vanadium					Vanadium	Kidney	6.2E-02			6.2E-02
			Total Risk Across Surface Soil				4.1E-05		Total Hazard Index Across Surface Soil				3.7E-01

Target Organ Analysis

Total CNS HI =	8.E-02	Total GS HI =	3.E-03
Total Blood HI =	9.E-02	Total Liver HI =	5.E-03
Total CVS HI =	6.E-02	Total Kidney HI =	6.E-02
Total Skin HI =	6.E-02		

TABLE 9.10. REASONABLE MAXIMUM EXPOSURE (RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - TOTAL RESIDENTIAL ILCRS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Child + Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	9.3E-06		3.6E-06	1.3E-05
			Benzo(a)pyrene	1.2E-04		4.5E-05	1.6E-04
			Benzo(b)fluoranthene	1.8E-05		6.8E-06	2.4E-05
			Benzo(k)fluoranthene	6.9E-07		2.6E-07	9.5E-07
			Chrysene	1.1E-07		4.1E-08	1.5E-07
			Dibenzo(a,h)anthracene	1.4E-05		5.4E-06	2.0E-05
			Indeno(1,2,3-cd)pyrene	4.2E-06		1.6E-06	5.8E-06
			Aluminum				
			Antimony				
			Arsenic	2.6E-05		2.4E-06	2.8E-05
			Barium				
			Copper				
			Iron				
			Manganese				
			Thallium				
			Vanadium				
			Total Risk Across Surface Soil				2.5E-04

TABLE 9.1a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - CONSTRUCTION/EXCAVATION WORKERS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Construction/Excavation Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	1.9E-08		5.0E-09	2.4E-08	Benzo(a)anthracene					
			Benzo(a)pyrene	2.4E-07		6.3E-08	3.1E-07	Benzo(a)pyrene					
			Benzo(b)fluoranthene	3.6E-08		9.5E-09	4.6E-08	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	1.4E-09		3.7E-10	1.8E-09	Benzo(k)fluoranthene					
			Chrysene	2.2E-10		5.8E-11	2.8E-10	Chrysene					
			Dibenzo(a,h)anthracene	2.9E-08		7.6E-09	3.7E-08	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	8.7E-09		2.3E-09	1.1E-08	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	1.4E-02			1.4E-02
			Antimony					Antimony	Blood	6.2E-02			6.2E-02
			Arsenic	2.3E-07		1.4E-08	2.4E-07	Arsenic	Skin, CVS	3.6E-02		2.1E-03	3.8E-02
			Barium					Barium	Kidney	1.7E-03	2.0E-01		2.0E-01
			Copper					Copper	GS	2.5E-03			2.5E-03
			Chromium		1.4E-06		1.4E-06	Chromium	Fetotoxicity/GS/Bone		8.1E-02		8.1E-02
			Iron					Iron	NA	5.3E-02			5.3E-02
			Manganese					Manganese	CNS	4.4E-02	5.0E+00		5.1E+00
			Thallium					Thallium	Liver	3.9E-03			3.9E-03
			Vanadium					Vanadium	Kidney	4.4E-02			4.4E-02
			Total Risk Across Surface Soil				2.1E-06		Total Hazard Index Across Surface Soil				5.6E+00

Target Organ Analysis

Total CNS HI =	5.E+00	Total GS HI =	8.E-02
Total Blood HI =	6.E-02	Total Liver HI =	4.E-03
Total CVS HI =	4.E-02	Total Kidney HI =	2.E-01
Total Skin HI =	4.E-02	Total Bone HI =	8.E-02
Total Fetotoxicity HI =	8.E-02		

TABLE 9.2a. CENTRAL TENDENCY EXPOSURE (CTE)

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - MAINTENANCE WORKERS

UXO NO. 7

NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Maintenance Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	4.2E-09		5.0E-09	9.2E-09	Benzo(a)anthracene					
			Benzo(a)pyrene	5.3E-08		6.3E-08	1.2E-07	Benzo(a)pyrene					
			Benzo(b)fluoranthene	7.9E-09		9.5E-09	1.7E-08	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	3.1E-10		3.7E-10	6.8E-10	Benzo(k)fluoranthene					
			Chrysene	4.8E-11		5.8E-11	1.1E-10	Chrysene					
			Dibenzo(a,h)anthracene	6.4E-09		7.6E-09	1.4E-08	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	1.9E-09		2.3E-09	4.2E-09	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	3.4E-04			3.4E-04
			Antimony					Antimony	Blood	1.5E-03			1.5E-03
			Arsenic	5.0E-08		1.4E-08	6.4E-08	Arsenic	Skin, CVS	8.6E-04		3.4E-05	9.0E-04
			Barium					Barium	Kidney	4.2E-05			4.2E-05
			Copper					Copper	GS	6.0E-05			6.0E-05
			Iron					Iron	NA	1.3E-03			1.3E-03
			Manganese					Manganese	CNS	1.1E-03			1.1E-03
			Thallium					Thallium	Liver	9.4E-05			9.4E-05
			Vanadium					Vanadium	Kidney	1.1E-03			1.1E-03
			Total Risk Across Surface Soil				2.2E-07			Total Hazard Index Across Surface Soil			6.3E-03

Target Organ Analysis

Total CNS HI =	1.E-03	Total GS HI =	6.E-05
Total Blood HI =	1.E-03	Total Liver HI =	9.E-05
Total CVS HI =	9.E-04	Total Kidney HI =	1.E-03
Total Skin HI =	9.E-04		

TABLE 9.3a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - OCCUPATIONAL WORKERS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Occupational Workers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	7.6E-08		1.3E-08	9.0E-08	Benzo(a)anthracene					
			Benzo(a)pyrene	9.7E-07		1.7E-07	1.1E-06	Benzo(a)pyrene					
			Benzo(b)fluoranthene	1.4E-07		2.5E-08	1.7E-07	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	5.6E-09		9.7E-10	6.6E-09	Benzo(k)fluoranthene					
			Chrysene	8.8E-10		1.5E-10	1.0E-09	Chrysene					
			Dibenzo(a,h)anthracene	1.2E-07		2.0E-08	1.4E-07	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	3.5E-08		5.9E-09	4.1E-08	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	6.2E-03			6.2E-03
			Antimony					Antimony	Blood	2.7E-02			2.7E-02
			Arsenic	9.1E-07		3.6E-08	9.5E-07	Arsenic	Skin, CVS	1.6E-02		6.2E-04	1.6E-02
			Barium					Barium	Kidney	7.7E-04			7.7E-04
			Copper					Copper	GS	1.1E-03			1.1E-03
			Iron					Iron	NA	2.3E-02			2.3E-02
			Manganese					Manganese	CNS	1.9E-02			1.9E-02
			Thallium					Thallium	Liver	1.7E-03			1.7E-03
			Vanadium					Vanadium	Kidney	1.9E-02			1.9E-02
			Total Risk Across Surface Soil				2.5E-06			Total Hazard Index Across Surface Soil			1.2E-01

Target Organ Analysis

Total CNS HI =	3.E-02	Total GS HI =	1.E-03
Total Blood HI =	3.E-02	Total Liver HI =	2.E-03
Total CVS HI =	2.E-02	Total Kidney HI =	2.E-02
Total Skin HI =	2.E-02		

TABLE 9.4a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - ASOLESCENT TRESPASSERS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Trespassers
Receptor Age: Adolescent (age 6 - 17)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	9.0E-09		2.9E-09	1.2E-08	Benzo(a)anthracene					
			Benzo(a)pyrene	1.1E-07		3.7E-08	1.5E-07	Benzo(a)pyrene					
			Benzo(b)fluoranthene	1.7E-08		5.5E-09	2.3E-08	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	6.7E-10		2.1E-10	8.8E-10	Benzo(k)fluoranthene					
			Chrysene	1.0E-10		3.4E-11	1.4E-10	Chrysene					
			Dibenzo(a,h)anthracene	1.4E-08		4.4E-09	1.8E-08	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	4.1E-09		1.3E-09	5.4E-09	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	6.0E-04			6.0E-04
			Antimony					Antimony	Blood	2.6E-03			2.6E-03
			Arsenic	1.1E-07		8.0E-09	1.2E-07	Arsenic	Skin, CVS	1.5E-03		1.1E-04	1.6E-03
			Barium					Barium	Kidney	7.5E-05			7.5E-05
			Copper					Copper	GS	1.1E-04			1.1E-04
			Iron					Iron	NA	2.2E-03			2.2E-03
			Manganese					Manganese	CNS	1.9E-03			1.9E-03
			Thallium					Thallium	Liver	1.7E-04			1.7E-04
			Vanadium					Vanadium	Kidney	1.9E-03			1.9E-03
			Total Risk Across Surface Soil				3.3E-07		Total Hazard Index Across Surface Soil				1.1E-02

Target Organ Analysis

Total CNS HI =	2.E-03	Total GS HI =	1.E-04
Total Blood HI =	3.E-03	Total Liver HI =	2.E-04
Total CVS HI =	2.E-03	Total Kidney HI =	2.E-03
Total Skin HI =	2.E-03		

TABLE 9.5a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - CHILD RECREATIONAL USERS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Recreational Users
Receptor Age: Child (0 to 6 years)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	9.4E-09		3.2E-09	1.3E-08	Benzo(a)anthracene					
			Benzo(a)pyrene	1.2E-07		4.1E-08	1.6E-07	Benzo(a)pyrene					
			Benzo(b)fluoranthene	1.8E-08		6.1E-09	2.4E-08	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	6.9E-10		2.4E-10	9.3E-10	Benzo(k)fluoranthene					
			Chrysene	1.1E-10		3.7E-11	1.5E-10	Chrysene					
			Dibenzo(a,h)anthracene	1.4E-08		4.9E-09	1.9E-08	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	4.3E-09		1.5E-09	5.7E-09	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	3.4E-03			3.4E-03
			Antimony					Antimony	Blood	1.5E-02			1.5E-02
			Arsenic	1.1E-07		8.9E-09	1.2E-07	Arsenic	Skin, CVS	8.7E-03		6.9E-04	9.4E-03
			Barium					Barium	Kidney	4.3E-04			4.3E-04
			Copper					Copper	GS	6.1E-04			6.1E-04
			Iron					Iron	NA	1.3E-02			1.3E-02
			Manganese					Manganese	CNS	1.1E-02			1.1E-02
			Thallium					Thallium	Liver	9.5E-04			9.5E-04
			Vanadium					Vanadium	Kidney	1.1E-02			1.1E-02
			Total Risk Across Surface Soil				3.4E-07		Total Hazard Index Across Surface Soil				6.4E-02

Target Organ Analysis

Total CNS HI =	1.E-02
Total Blood HI =	2.E-02
Total CVS HI =	9.E-03
Total Skin HI =	9.E-03
Total GS HI =	6.E-04
Total Liver HI =	9.E-04
Total Kidney HI =	1.E-02

TABLE 9.6a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - ADULT RECREATIONAL USERS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Recreational Users
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	3.5E-09		1.7E-09	5.2E-09	Benzo(a)anthracene					
			Benzo(a)pyrene	4.5E-08		2.1E-08	6.6E-08	Benzo(a)pyrene					
			Benzo(b)fluoranthene	6.7E-09		3.2E-09	9.8E-09	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	2.6E-10		1.2E-10	3.8E-10	Benzo(k)fluoranthene					
			Chrysene	4.1E-11		1.9E-11	6.0E-11	Chrysene					
			Dibenzo(a,h)anthracene	5.4E-09		2.5E-09	7.9E-09	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	1.6E-09		7.5E-10	2.4E-09	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	3.7E-04			3.7E-04
			Antimony					Antimony	Blood	1.6E-03			1.6E-03
			Arsenic	4.2E-08		4.6E-09	4.7E-08	Arsenic	Skin, CVS	9.3E-04		1.0E-04	1.0E-03
			Barium					Barium	Kidney	4.6E-05			4.6E-05
			Copper					Copper	GS	6.5E-05			6.5E-05
			Iron					Iron	NA	1.4E-03			1.4E-03
			Manganese					Manganese	CNS	1.1E-03			1.1E-03
			Thallium					Thallium	Liver	1.0E-04			1.0E-04
			Vanadium					Vanadium	Kidney	1.1E-03			1.1E-03
			Total Risk Across Surface Soil				1.4E-07			Total Hazard Index Across Surface Soil			6.9E-03

Target Organ Analysis

Total CNS HI =	2.E-03	Total GS HI =	6.E-05
Total Blood HI =	2.E-03	Total Liver HI =	1.E-04
Total CVS HI =	1.E-03	Total Kidney HI =	1.E-03
Total Skin HI =	1.E-03		

TABLE 9.7a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - TOTAL RECREATIONAL ILCRS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Recreational Users
Receptor Age: Child + Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	1.3E-08		4.9E-09	1.8E-08
			Benzo(a)pyrene	1.6E-07		6.2E-08	2.3E-07
			Benzo(b)fluoranthene	2.5E-08		9.3E-09	3.4E-08
			Benzo(k)fluoranthene	9.5E-10		3.6E-10	1.3E-09
			Chrysene	1.5E-10		5.7E-11	2.1E-10
			Dibenzo(a,h)anthracene	2.0E-08		7.5E-09	2.7E-08
			Indeno(1,2,3-cd)pyrene	5.9E-09		2.2E-09	8.1E-09
			Aluminum				
			Antimony				
			Arsenic	1.5E-07		1.3E-08	1.7E-07
			Barium				
			Copper				
			Iron				
			Manganese				
			Thallium				
			Vanadium				
			Total Risk Across Surface Soil				4.8E-07

TABLE 9.8a. CENTRAL TENDENCY EXPOSURE (CTE)

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - FUTURE CHILD RESIDENT

UXO NO. 7

NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child (0 to 6 years)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	1.7E-07		2.5E-08	1.9E-07	Benzo(a)anthracene					
			Benzo(a)pyrene	2.1E-06		3.1E-07	2.5E-06	Benzo(a)pyrene					
			Benzo(b)fluoranthene	3.2E-07		4.7E-08	3.7E-07	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	1.2E-08		1.8E-09	1.4E-08	Benzo(k)fluoranthene					
			Chrysene	2.0E-09		2.9E-10	2.2E-09	Chrysene					
			Dibenzo(a,h)anthracene	2.6E-07		3.8E-08	3.0E-07	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	7.7E-08		1.1E-08	8.8E-08	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	6.2E-02			6.2E-02
			Antimony					Antimony	Blood	2.7E-01			2.7E-01
			Arsenic	2.0E-06		6.8E-08	2.1E-06	Arsenic	Skin, CVS	1.6E-01		5.3E-03	1.6E-01
			Barium					Barium	Kidney	7.7E-03			7.7E-03
			Copper					Copper	GS	1.1E-02			1.1E-02
			Iron					Iron	NA	2.3E-01			2.3E-01
			Manganese					Manganese	CNS	1.9E-01			1.9E-01
			Thallium					Thallium	Liver	1.7E-02			1.7E-02
			Vanadium					Vanadium	Kidney	1.9E-01			1.9E-01
			Total Risk Across Surface Soil				5.5E-06		Total Hazard Index Across Surface Soil				1.1E+00

Target Organ Analysis

Total CNS HI =	3.E-01	Total GS HI =	1.E-02
Total Blood HI =	3.E-01	Total Liver HI =	2.E-02
Total CVS HI =	2.E-01	Total Kidney HI =	2.E-01
Total Skin HI =	2.E-01		

TABLE 9.9a. CENTRAL TENDENCY EXPOSURE (CTE)

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - FUTURE ADULT RESIDENT

UXO NO. 7

NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	6.4E-08		9.4E-09	7.3E-08	Benzo(a)anthracene					
			Benzo(a)pyrene	8.0E-07		1.2E-07	9.2E-07	Benzo(a)pyrene					
			Benzo(b)fluoranthene	1.2E-07		1.8E-08	1.4E-07	Benzo(b)fluoranthene					
			Benzo(k)fluoranthene	4.7E-09		6.9E-10	5.4E-09	Benzo(k)fluoranthene					
			Chrysene	7.4E-10		1.1E-10	8.4E-10	Chrysene					
			Dibenzo(a,h)anthracene	9.7E-08		1.4E-08	1.1E-07	Dibenzo(a,h)anthracene					
			Indeno(1,2,3-cd)pyrene	2.9E-08		4.3E-09	3.3E-08	Indeno(1,2,3-cd)pyrene					
			Aluminum					Aluminum	CNS	6.6E-03			6.6E-03
			Antimony					Antimony	Blood	2.9E-02			2.9E-02
			Arsenic	7.6E-07		2.6E-08	7.8E-07	Arsenic	Skin, CVS	1.7E-02		5.7E-04	1.7E-02
			Barium					Barium	Kidney	8.3E-04			8.3E-04
			Copper					Copper	GS	1.2E-03			1.2E-03
			Iron					Iron	NA	2.5E-02			2.5E-02
			Manganese					Manganese	CNS	2.1E-02			2.1E-02
			Thallium					Thallium	Liver	1.8E-03			1.8E-03
			Vanadium					Vanadium	Kidney	2.1E-02			2.1E-02
						Total Risk Across Surface Soil	2.1E-06					Total Hazard Index Across Surface Soil	1.2E-01

Target Organ Analysis

Total CNS HI =	3.E-02
Total Blood HI =	3.E-02
Total CVS HI =	2.E-02
Total Skin HI =	2.E-02
Total GS HI =	1.E-03
Total Liver HI =	2.E-03
Total Kidney HI =	2.E-02

TABLE 9.10a. CENTRAL TENDENCY EXPOSURE (CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS - TOTAL RESIDENTIAL ILCRS
UXO NO. 7
NSWC CRANE, CRANE, INDIANA

Scenario Timeframe: Future
Receptor Population: Residents
Receptor Age: Child + Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Surface Soil	Benzo(a)anthracene	2.3E-07		3.4E-08	2.7E-07
			Benzo(a)pyrene	2.9E-06		4.3E-07	3.4E-06
			Benzo(b)fluoranthene	4.4E-07		6.5E-08	5.1E-07
			Benzo(k)fluoranthene	1.7E-08		2.5E-09	2.0E-08
			Chrysene	2.7E-09		3.9E-10	3.1E-09
			Dibenzo(a,h)anthracene	3.6E-07		5.2E-08	4.1E-07
			Indeno(1,2,3-cd)pyrene	1.1E-07		1.5E-08	1.2E-07
			Aluminum				
			Antimony				
			Arsenic	2.8E-06		9.4E-08	2.9E-06
			Barium				
			Copper				
			Iron				
			Manganese				
			Thallium				
			Vanadium				
			Total Risk Across Surface Soil				7.6E-06

EXAMPLE RISK ASSESSMENT CALCULATIONS

CLIENT: NSWC CRANE, UXO NO.7		**JOB NUMBER:** 00447
SUBJECT: CALCULATION OF INTAKE/RISK FROM INCIDENTAL INGESTION OF SOIL FOR MUTAGENIC CHEMICALS - HYPOTHETICAL CHILD RESIDENTS		
BASED ON: U.S. EPA, DECEMBER 1989		
BY: T. JACKMAN	**CHECKED BY:**	**DATE:** 5/21/2008

PURPOSE: To estimate intake and cancer risks for mutagenic chemicals from incidental ingestion of surface soil.

EQUATION:

$$IEX = \frac{CS \times IR \times EF \times ED \times FI \times CF}{BW \times AT} \times ADAF$$

Where:

IEX	=	estimated exposure intake (mg/kg/day)
Cs	=	exposure point concentration in soil (mg/kg)
IR	=	incidental ingestion rate (mg/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
FI	=	fraction ingested from contaminated source (unitless)
CF	=	conversion factor (1.0E-6 kg/mg)
BW	=	body weight (kg)
AT	=	averaging time (days)
ADAF	=	age-dependent adjustment factor
CSFo	=	oral carcinogenic slope factor ((mg/kg/day)$^{-1}$)

RISKS:

ILCR (Carcinogens) = Intake (mg/kg/day) x CSFo (mg/kg/day)-1

ASSUMPTIONS:

Cs	=	2.4	mg/kg	Chemical: Benzo(a)pyrene
IR	=	200	mg/day	
EF	=	350	days/year	
ED_1	=	2	years	
ED_2	=	4	years	
FI	=	1		
CF	=	1.0E-06	kg/mg	
BW	=	15	kg	
AT	=	25550	days	
CSFo	=	7.3E+00	(mg/kg/day)$^{-1}$	
$ADAF_1$	=	10		
$ADAF_2$	=	3		

CLIENT: NSWC CRANE, UXO NO.7		JOB NUMBER: 00447
SUBJECT: CALCULATION OF INTAKE/RISK FROM INCIDENTAL INGESTION OF SOIL FOR MUTAGENIC CHEMICALS - HYPOTHETICAL CHILD RESIDENTS		
BASED ON: U.S. EPA, DECEMBER 1989		
BY: T. JACKMAN	CHECKED BY:	DATE: 5/21/2008

EXAMPLE CARCINOGENIC CALCULATION

$$IEX_1 = \frac{2.4 \text{ mg/kg} \times 200 \text{ mg/day} \times 350 \text{ days/year} \times 2 \text{ years} \times 1 \times 1.0E\text{-}06 \text{ kg/mg}}{15 \text{ kg} \times 25550 \text{ days}} \times 10$$

IEX_1 = 8.77E-06 mg/kg/day

$$IEX_2 = \frac{2.4 \text{ mg/kg} \times 200 \text{ mg/day} \times 350 \text{ days/year} \times 4 \text{ years} \times 1 \times 1.0E\text{-}06 \text{ kg/mg}}{15 \text{ kg} \times 25550 \text{ days}} \times 3$$

IEX_2 = 5.26E-06 mg/kg/day

ILCR = (8.77E-06 mg/kg/day + 5.26E-06 mg/kg/day) x 7.30E+00 (mg/kg/day)-1

ILCR = 1.0E-04

CLIENT: NSWC CRANE, UXO NO.7		JOB NUMBER: 00447
SUBJECT: CALCULATION OF INTAKE/RISK FROM DERMAL CONTACT WITH SOIL FOR MUTAGENIC CHEMICALS HYPOTHETICAL CHILD RESIDENTS		
BASED ON: U.S. EPA, JULY 2004		
BY: T. Jackman	CHECKED BY:	DATE: 5/21/2008

PURPOSE: To estimate intake and cancer risks for mutagenic chemicals from dermal contact with surface soil.

EQUATION:

$$DEX = \frac{Cs \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT} \times ADAF$$

Where:

DEX	=	estimated exposure intake (mg/kg/day)
Cs	=	exposure point concentration in soil (mg/kg)
CF	=	conversion factor (1.0E-6 kg/mg)
SA	=	skin surface available for contact (cm^2/day)
ABS	=	absorption factor (unitless)
AF	=	adherence factor (mg/cm^2)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)
ADAF	=	age-dependent adjustment factor
CSFd	=	dermal carcinogenic slope factor ($(mg/kg/day)^{-1}$)

RISKS:

ILCR (Carcinogens) = Intake (mg/kg/day) x CSFd (mg/kg/day)-1

ASSUMPTIONS:

Cs	=	2.4	mg/kg	Chemical: Benzo(a)pyrene
CF	=	1.0E-06	kg/mg	
SA	=	2800	cm^2/day	
AF	=	0.2	mg/cm^2	
ABS	=	0.13		
EF	=	350	days/year	
ED_1	=	2	years	
ED_2	=	4	years	
BW	=	15	kg	
AT	=	25550	days	
CSFd	=	7.3E+00	$(mg/kg/day)^{-1}$	
$ADAF_1$	=	10		
$ADAF_2$	=	3		

CLIENT: NSWC CRANE, UXO NO.7	**JOB NUMBER:** 00447
SUBJECT: CALCULATION OF INTAKE/RISK FROM DERMAL CONTACT WITH SOIL FOR MUTAGENIC CHEMICALS HYPOTHETICAL CHILD RESIDENTS	
BASED ON: U.S. EPA, JULY 2004	

BY:	**CHECKED BY:**	**DATE:**
T. Jackman		5/21/2008

EXAMPLE CARCINOGENIC CALCULATION

$$\text{DEXc} = \frac{2.4\text{ mg/kg} \times 1.0\text{E-06 kg/mg} \times 2800\text{ cm2/day} \times 0.2\text{ mg/cm2} \times 0.13 \times 350\text{ days/year} \times 2\text{ years}}{15\text{ kg} \times 25550\text{ days}} \times 10$$

DEXc = 3.19E-06 mg/kg/day

$$\text{DEXc} = \frac{2.4\text{ mg/kg} \times 1.0\text{E-06 kg/mg} \times 2800\text{ cm2/day} \times 0.2\text{ mg/cm2} \times 0.13 \times 350\text{ days/year} \times 4\text{ years}}{15\text{ kg} \times 25550\text{ days}} \times 3$$

DEXc = 1.91E-06 mg/kg/day

ILCR = (3.19E-06 mg/kg/day + 1.91E-06 mg/kg/day) x 7.30E+00 (mg/kg/day)-1

ILCR = 3.7E-05

CALCULATION WORKSHEET

CLIENT: NSWC CRANE, UXO NO.7		**JOB NUMBER:** 00447
SUBJECT: CALCULATION OF INTAKE/RISK FROM INCIDENTAL INGESTION OF SOIL FOR MUTAGENIC CHEMICALS - HYPOTHETICAL ADULT RESIDENTS		
BASED ON: U.S. EPA, DECEMBER 1989		
BY: T. Jackman	**CHECKED BY:**	**DATE:** 5/21/2008

PURPOSE: To estimate intake and cancer risks for mutagenic chemicals from incidental ingestion of surface soil.

EQUATION:

$$IEX = \frac{CS \times IR \times EF \times ED \times FI \times CF}{BW \times AT} \times ADAF$$

Where:

IEX	=	estimated exposure intake (mg/kg/day)
Cs	=	exposure point concentration in soil (mg/kg)
IR	=	incidental ingestion rate (mg/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
FI	=	fraction ingested from contaminated source (unitless)
CF	=	conversion factor (1.0E-6 kg/mg)
BW	=	body weight (kg)
AT	=	averaging time (days)
ADAF	=	age-dependent adjustment factor
CSFo	=	oral carcinogenic slope factor ($(mg/kg/day)^{-1}$)

RISKS:

ILCR (Carcinogens) = Intake (mg/kg/day) x CSFo (mg/kg/day)-1

ASSUMPTIONS:

Cs	=	2.4	mg/kg	Chemical: Benzo(a)pyrene
IR	=	100	mg/day	
EF	=	350	days/year	
ED_1	=	10	years	
ED_2	=	14	years	
FI	=	1		
CF	=	1.0E-06	kg/mg	
BW	=	70	kg	
AT	=	25550	days	
CSFo	=	7.3E+00	$(mg/kg/day)^{-1}$	
$ADAF_1$	=	3		
$ADAF_2$	=	1		

CLIENT: NSWC CRANE, UXO NO.7		**JOB NUMBER:** 00447
SUBJECT: CALCULATION OF INTAKE/RISK FROM INCIDENTAL INGESTION OF SOIL FOR MUTAGENIC CHEMICALS - HYPOTHETICAL ADULT RESIDENTS		
BASED ON: U.S. EPA, DECEMBER 1989		
BY: T. Jackman	**CHECKED BY:**	**DATE:** 5/21/2008

EXAMPLE CARCINOGENIC CALCULATION

$$IEX_1 = \frac{2.4 \text{ mg/kg x } 100 \text{ mg/day x } 350 \text{ days/year x } 10 \text{ years x } 1 \text{ x } 1.0\text{E-}06 \text{ kg/mg}}{70 \text{ kg x } 25550 \text{ days}} \text{ x } 3$$

IEX_1 = 1.41E-06 mg/kg/day

$$IEX_2 = \frac{2.4 \text{ mg/kg x } 100 \text{ mg/day x } 350 \text{ days/year x } 14 \text{ years x } 1 \text{ x } 1.0\text{E-}06 \text{ kg/mg}}{70 \text{ kg x } 25550 \text{ days}} \text{ x } 1$$

IEX_2 = 6.58E-07 mg/kg/day

ILCR = (1.41E-06 mg/kg/day + 6.58E-07 mg/kg/day) x 7.30E+00 (mg/kg/day)-1

ILCR = 1.5E-05

CLIENT: NSWC CRANE, UXO NO.7		JOB NUMBER: 00447
SUBJECT: CALCULATION OF INTAKE/RISK FROM DERMAL CONTACT WITH SOIL FOR MUTAGENIC CHEMICALS HYPOTHETICAL ADULT RESIDENTS		
BASED ON: U.S. EPA, JULY 2004		
BY: T. Jackman	CHECKED BY:	DATE: 5/21/2008

PURPOSE: To estimate intake and cancer risks for mutagenic chemicals from dermal contact with surface/subsurface soil at Zone 1.

EQUATION:

$$DEX = \frac{Cs \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT} \times ADAF$$

Where:

DEX	=	estimated exposure intake (mg/kg/day)
Cs	=	exposure point concentration in soil (mg/kg)
CF	=	conversion factor (1.0E-6 kg/mg)
SA	=	skin surface available for contact (cm^2/day)
ABS	=	absorption factor (unitless)
AF	=	adherence factor (mg/cm^2)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)
ADAF	=	age-dependent adjustment factor
CSFd	=	dermal carcinogenic slope factor ($(mg/kg/day)^{-1}$)

RISKS:

ILCR (Carcinogens) = Intake (mg/kg/day) x CSFd (mg/kg/day)-1

ASSUMPTIONS:

Cs	=	2.4	mg/kg	Chemical: Benzo(a)pyrene
CF	=	1.0E-06	kg/mg	
SA	=	5700	cm^2/day	
AF	=	0.07	mg/cm^2	
ABS	=	0.13		
EF	=	350	days/year	
ED_1	=	10	years	
ED_2	=	14	years	
BW	=	70	kg	
AT	=	25550	days	
CSFd	=	7.3E+00	$(mg/kg/day)^{-1}$	
$ADAF_1$	=	3		
$ADAF_2$	=	1		

CLIENT: NSWC CRANE, UXO NO.7		JOB NUMBER: 00447
SUBJECT: CALCULATION OF INTAKE/RISK FROM DERMAL CONTACT WITH SOIL FOR MUTAGENIC CHEMICALS HYPOTHETICAL ADULT RESIDENTS		
BASED ON: U.S. EPA, JULY 2004		
BY: T. Jackman	CHECKED BY:	DATE: 5/21/2008

EXAMPLE CARCINOGENIC CALCULATION

DEXc = $\dfrac{\text{2.4 mg/kg x 1.0E-06 kg/mg x 5700 cm2/day x 0.07 mg/cm2 x 0.13 x 350 days/year x 10 years}}{\text{70 kg x 25550 days}}$ x 3

DEXc = 7.31E-07 mg/kg/day

DEXc = $\dfrac{\text{2.4 mg/kg x 1.0E-06 kg/mg x 5700 cm2/day x 0.07 mg/cm2 x 0.13 x 350 days/year x 14 years}}{\text{70 kg x 25550 days}}$ x 1

DEXc = 3.41E-07 mg/kg/day

ILCR = (7.31E-07 mg/kg/day + 3.41E-07 mg/kg/day) x 7.30E+00 (mg/kg/day)-1

ILCR = 7.8E-06

CLIENT: NSWC CRANE, UXO NO. 7	**JOB NUMBER:** 00447
SUBJECT: ESTIMATION OF AMBIENT AIR CONCENTRATIONS RESULTING FROM FUGITIVE DUST EMISSIONS CONSTRUCTION WORKER	
BASED ON: U.S. EPA 1996 AND 2002	

BY: T.JACKMAN	**CHECKED BY:**	**DATE:** 08/15/08

PURPOSE: To calculate ambient air concentrations resulting from fugitive dust from surface soil.

RELEVANT EQUATIONS:

Cair = Cs x (1/PEF)

Where:

Cair = Chemical concentration in air (mg/m^3)
Cs = Chemical concentration in soil (mg/kg)
PEF = Particulate emission factor (m^3/kg)

ASSUMPTIONS:

Cs	=	903	mg/kg	Chemical: Manganese
PEF	=	1.50E+06	m3/kg	
Cair	=	6.01E-04	mg/m^3	

CLIENT: NSWC CRANE, UXO NO. 7		**JOB NUMBER:** 00447
SUBJECT: CALCULATION OF PARTICUALATE EMISSION FACTOR FOR CONSTRUCTION WORKERS		
BASED ON: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA, Dec. 2002)		
BY: T. JACKMAN	**CHECKED BY:**	**DATE:** 07/16/09

Equation 5-5
Derivation of the Particulate Emission Factor
Construction Scenario - Construction Worker

$$PEF_{sc} = Q/C_{sr} \times \frac{1}{F_D} \times \left[\frac{T \times A_R}{556 \times \left(\frac{W}{3}\right)^{0.4} \times \frac{(365d/yr - p)}{365d/yr} \times \sum VKT} \right]$$

Parameter/Definition (units)	Default
PEF_{sc}/subchronic road particulate emission factor (m^3/kg)	site-specific
Q/C_{sr}/ inverse of 1-h average air concentration along a straight road segment bisecting a 0.5-acre square site (g/m^2-s per kg/m^3)	23.02
F_D/dispersion correction factor (unitless)	0.185 (Appendix E)
T/total time over which construction occurs (s)	site-specific
A_R/surface area of contaminated road segment (m^2) L_R/length of road segment (ft) W_R/width of road segment (ft)	274.213 ($A_R = L_R \times W_R \times 0.092903 m^2/ft^2$)
W/mean vehicle weight (tons)	site-specific
p/number of days with at least 0.01 inches of precipitation (days/year) (see Figure 5-2)	site-specific
$\sum$VKT/sum of fleet vehicle kilometers traveled during the exposure duration (km)	site-specific

Calculation of PEF for Construction Workers

Q/C	23.02	(g/m2-s per kg/m3)	
Fd	0.185	dispersion correction factor (unitless)	
T	4.32E+06	sec	3600 sec/hr x 8hr/day x 150 days/yr
Area (A)	274.213	m^2	
W	8	tons	
p	150	day/year	
VKT	202.5	km	

PEF = 1.50E+06 m^3/kg

CALCULATION WORKSHEET

CLIENT: NSWC CRANE, UXO NO. 7		**JOB NUMBER:** 00447
SUBJECT: CALCULATION OF INTAKE/RISK FROM INHALATION OF FUGATIVE DUST EMISSIONS BY CONSTRUCTION WORKERS		
BASED ON: USEPA, DEC. 1989		
BY: T.JACKMAN	**CHECKED BY:**	**DATE:** 8/18/2008

PURPOSE: To estimate intake, carcinogenic and noncarcinogenic risks from inhalation of fugitive dust and volatiles by full-time employees at Building A.

EQUATION:

$$IEX = \frac{Ca \times IR \times ET \times EF \times ED}{BW \times AT}$$

Where:

IEX	=	estimated exposure intake (mg/kg-day)
Ca	=	exposure point concentration in air (mg/m3)
IR	=	inhlation rate (m3/hr)
ET	=	exposure time (hrs/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)
CSFi	=	inhalation carcinogenic slope factor (kg-day/mg)
RfDi	=	inhalation noncarcinogenic reference dose (mg/kg-day)

RISKS:

ICLR (Carcinogens) = Intake (mg/kg/day) x CSFi (kg-day/mg)
HQ (Noncarcinogens) = Intake (mg/kg/day) / RFDi (mg/kg-day)

ASSUMPTIONS:

Ca	=	6.0E-04	mg/m^3	Manganese
IR	=	2.5	m^3/hr	
ET	=	8	hr/day	
EF	=	150	days/year	
ED	=	1	years	
BW	=	70	kg	
ATc	=	25550	days	
ATnc	=	365	days	
CSFi	=	NA	(kg-day/mg)	
RfDi	=	1.40E-05	mg/kg-day	

CLIENT: NSWC CRANE, UXO NO. 7		JOB NUMBER: 00447
SUBJECT: CALCULATION OF INTAKE/RISK FROM INHALATION OF FUGATIVE DUST EMISSIONS BY CONSTRUCTION WORKERS		
BASED ON: USEPA, DEC. 1989		
BY: T.JACKMAN	CHECKED BY:	DATE: 8/18/2008

EXAMPLE CARCINOGENIC CALCULATION

$$IEXc = \frac{6.0E\text{-}04 \text{ mg/m3} \times 2.5 \text{ m3/hr} \times 8 \text{ hr/day} \times 150 \text{ days/year} \times 1 \text{ years}}{70 \text{ kg} \times 25550 \text{ days}}$$

IEXc = 1.01E-06 mg/kg-day

ICLR = 1.01E-06 mg/kg-day x NA (kg-day/mg) = Incremental Lifetime Cancer Risk

ICLR = NA

EXAMPLE NONCARCINOGENIC CALCULATION

$$IEXnc = \frac{6.0E\text{-}04 \text{ mg/m3} \times 2.5 \text{ m3/hr} \times 8 \text{ hr/day} \times 150 \text{ days/year} \times 1 \text{ years}}{70 \text{ kg} \times 365 \text{ days}}$$

IEXnc = 7.06E-05 mg/kg-day

HQ = 7.06E-05 mg/kg-day / 1.4E-05 mg/kg-day

HQ = **5.0**

LEAD MODELING RESULTS – UXO NO. 7

Calculations of Preliminary Remediation Goals (PRGs)

Calculations of Blood Lead Concentrations (PbBs) - Construction Worker - UXO No. 7

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 05/19/03

Exposure Variable	PbB Equation[1] 1*	PbB Equation[1] 2**	Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario: Using Equation 1, GSDi = Hom	Using Equation 1, GSDi = Het	Using Equation 2, GSDi = Hom	Using Equation 2, GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm	278	278	278	278
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSD_i	X	X	Geometric standard deviation PbB	--	2.1	2.3	2.1	2.3
PbB_0	X	X	Baseline PbB	ug/dL	1.5	1.7	1.5	1.7
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050	0.050	--	--
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.050	0.050
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--	1.0	1.0
K_{SD}		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
$AF_{S, D}$	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
$EF_{S, D}$	X	X	Exposure frequency (same for soil and dust)	days/yr	150	150	150	150
$AT_{S, D}$	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbB_{adult}			**PbB of adult worker, geometric mean**	ug/dL	**1.8**	**2.0**	**1.8**	**2.0**
$PbB_{fetal, 0.95}$			**95th percentile PbB among fetuses of adult workers**	ug/dL	**5.4**	**7.0**	**5.4**	**7.0**
PbB_t			**Target PbB level of concern (e.g., 10 ug/dL)**	ug/dL	**10.0**	**10.0**	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$			**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	%	**0.7%**	**1.9%**	**0.7%**	**1.9%**

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

$$PbB_{adult} = (PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_S/AT_{S,D}) + PbB_0$$

$$PbB_{fetal, 0.95} = PbB_{adult} * (GSD_i^{1.645} * R)$$

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

$$PbB_{adult} = PbS*BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])/365+PbB_0$$

$$PbB_{fetal, 0.95} = PbB_{adult} * (GSD_i^{1.645} * R)$$

Source: U.S. EPA (1996). Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

Calculations of Preliminary Remediation Goals (PRGs)

Calculations of Blood Lead Concentrations (PbBs) - Maintenance Worker - UXO No. 7

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 05/19/03

Exposure Variable	PbB Equation[1]		Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario			
					Using Equation 1		Using Equation 2	
	1*	2**			GSDi = Hom	GSDi = Het	GSDi = Hom	GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm	278	278	278	278
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSD_i	X	X	Geometric standard deviation PbB	--	2.1	2.3	2.1	2.3
PbB_0	X	X	Baseline PbB	ug/dL	1.5	1.7	1.5	1.7
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050	0.050	--	--
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.050	0.050
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--	1.0	1.0
K_{SD}		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
$AF_{S, D}$	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
$EF_{S, D}$	X	X	Exposure frequency (same for soil and dust)	days/yr	24	24	24	24
$AT_{S, D}$	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbB_{adult}			**PbB of adult worker, geometric mean**	ug/dL	**1.5**	**1.7**	**1.5**	**1.7**
$PbB_{fetal, 0.95}$			**95th percentile PbB among fetuses of adult workers**	ug/dL	**4.7**	**6.2**	**4.7**	**6.2**
PbB_t			**Target PbB level of concern (e.g., 10 ug/dL)**	ug/dL	**10.0**	**10.0**	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$			**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	%	**0.4%**	**1.3%**	**0.4%**	**1.3%**

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB_{adult} =	$(PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_S/AT_{S,D}) + PbB_0$
$PbB_{fetal, 0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB_{adult} =	$PbS*BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])/365+PbB_0$
$PbB_{fetal, 0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

Source: U.S. EPA (1996). Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

Calculations of Preliminary Remediation Goals (PRGs)

Calculations of Blood Lead Concentrations (PbBs) - Occupational Worker - UXO No. 7

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 05/19/03

Exposure Variable	PbB Equation[1] 1*	PbB Equation[1] 2**	Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario: Using Equation 1, GSDi = Hom	Using Equation 1, GSDi = Het	Using Equation 2, GSDi = Hom	Using Equation 2, GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm	278	278	278	278
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSD_i	X	X	Geometric standard deviation PbB	--	2.1	2.3	2.1	2.3
PbB_0	X	X	Baseline PbB	ug/dL	1.5	1.7	1.5	1.7
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050	0.050	--	--
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.050	0.050
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--	1.0	1.0
K_{SD}		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
$AF_{S,D}$	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
$EF_{S,D}$	X	X	Exposure frequency (same for soil and dust)	days/yr	250	250	250	250
$AT_{S,D}$	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbB_{adult}			**PbB of adult worker, geometric mean**	**ug/dL**	**2.0**	**2.2**	**2.0**	**2.2**
$PbB_{fetal, 0.95}$			**95th percentile PbB among fetuses of adult workers**	**ug/dL**	**6.0**	**7.6**	**6.0**	**7.6**
PbB_t			**Target PbB level of concern (e.g., 10 ug/dL)**	**ug/dL**	**10.0**	**10.0**	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$			**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**1.0%**	**2.5%**	**1.0%**	**2.5%**

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB_{adult} =	$(PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_S/AT_{S,D}) + PbB_0$
$PbB_{fetal, 0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB_{adult} =	$PbS*BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])/365+PbB_0$
$PbB_{fetal, 0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

Source: U.S. EPA (1996). Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

Calculations of Preliminary Remediation Goals (PRGs)

Calculations of Blood Lead Concentrations (PbBs) - Adult Recreational User - UXO No. 7

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 05/19/03

Exposure Variable	PbB Equation[1] 1*	2**	Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario: Using Equation 1, GSDi = Hom	Using Equation 1, GSDi = Het	Using Equation 2, GSDi = Hom	Using Equation 2, GSDi = Het
PbS	X	X	Soil lead concentration	ug/g or ppm	278	278	278	278
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSD_i	X	X	Geometric standard deviation PbB	--	2.1	2.3	2.1	2.3
PbB_0	X	X	Baseline PbB	ug/dL	1.5	1.7	1.5	1.7
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100	0.100	--	--
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.100	0.100
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--	1.0	1.0
K_{SD}		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
$AF_{S,D}$	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
$EF_{S,D}$	X	X	Exposure frequency (same for soil and dust)	days/yr	52	52	52	52
$AT_{S,D}$	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
PbB_{adult}			**PbB of adult worker, geometric mean**	**ug/dL**	**1.7**	**1.9**	**1.7**	**1.9**
$PbB_{fetal,0.95}$			**95th percentile PbB among fetuses of adult workers**	**ug/dL**	**5.2**	**6.7**	**5.2**	**6.7**
PbB_t			**Target PbB level of concern (e.g., 10 ug/dL)**	**ug/dL**	**10.0**	**10.0**	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$			**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.6%**	**1.7%**	**0.6%**	**1.7%**

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same $PbB_{fetal,0.95}$.

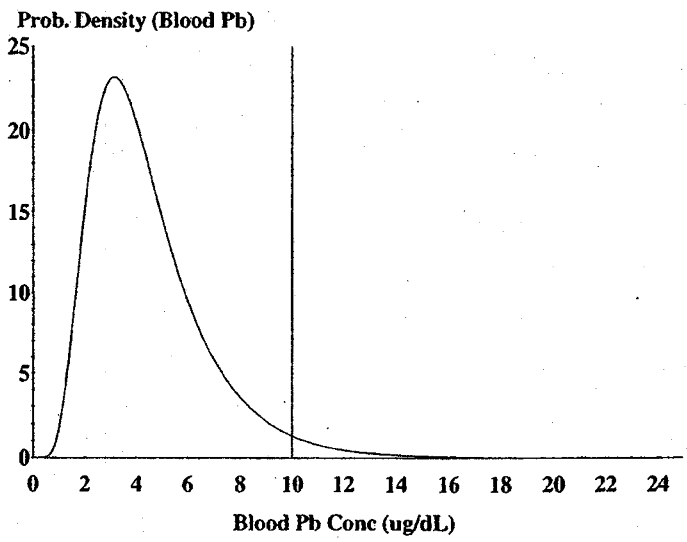
***Equation 1, based on Eq. 1, 2 in USEPA (1996).**

PbB_{adult} =	$(PbS*BKSF*IR_{S+D}*AF_{S,D}*EF_S/AT_{S,D}) + PbB_0$
$PbB_{fetal,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

****Equation 2, alternate approach based on Eq. 1, 2, and A-19 in USEPA (1996).**

PbB_{adult} =	$PbS*BKSF*([(IR_{S+D})*AF_S*EF_S*W_S]+[K_{SD}*(IR_{S+D})*(1-W_S)*AF_D*EF_D])/365+PbB_0$
$PbB_{fetal,0.95}$ =	$PbB_{adult} * (GSD_i^{1.645} * R)$

Source: U.S. EPA (1996). Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil



Cutoff = 10.000 ug/dl
Geo Mean = 4.083
GSD = 1.600
% Above = 2.834
% Below = 97.166

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research

APPENDIX F

ECOLOGICAL RISK SUPPORTING DOCUMENTATION

APPENDIX F

CHEMICAL CLASS DESCRIPTIONS
UXO 7 – OLD RIFLE RANGE
NSWC CRANE
CRANE, INDIANA

This appendix presents a discussion of the different chemical classes to be analyzed at UXO 7, including toxicity information, potential food chain and trophic transfer, and bioaccumulation potential. Appendix Table F.3 presents the bioaccumulation factors (BAFs) that were used in the surrogate species' food-chain models for the individual constituents that are detected at UXO 7. The sources for most of the BAFs are presented in this appendix, while the text below discusses some additional sources of the BAFs, where necessary. Note that dry weight BAFs were used for this ERA.

Polynuclear Aromatic Hydocarbons

Polynuclear aromatic hydocarbons (PAHs) are a diverse group of compounds consisting of two or more substituted and unsubstituted polynuclear aromatic rings formed by the incomplete combustion of carbonaceous materials. PAHs are ubiquitous in the modern environment and are common constituents of coal tar, soot, vehicle exhaust, cigarette smoke, certain petroleum products, road tar, mineral oils, creosote, and many cooked foods. PAHs also are released to the environment through natural sources such as volcanoes and forest fires.

PAHs are transferred from surface water by volatilization and sorption to settling particles. The compounds are transformed in surface water by photooxidation, chemical oxidation, and microbial metabolism (ATSDR, 1989). In soil and sediments, microbial metabolism is the major process for degradation of PAHs (ATSDR, 1989). Although PAHs accumulate in terrestrial and aquatic plants, many organisms are able to metabolize and eliminate these compounds. Vertebrates can readily metabolize PAHs, but lower forms (insects and worms) cannot metabolize PAHs as quickly. However, food chain uptake does not appear to be a major exposure source to PAHs for aquatic animals (ATSDR, 1989).

PAHs vary substantially in their toxicity to aquatic organisms. In general, toxicity increases as molecular weight increases, with the exception of some high molecular weight PAHs that have low acute toxicity. Most species of aquatic organisms rapidly accumulate PAHs that occur at low concentrations in the ambient medium. However, uptake of PAHs is highly species-specific, it is higher in algae, mollusks, and other species that are incapable of metabolizing PAHs (Eisler, 1987). The ability of fish to metabolize PAHs may explain why benzo(a)pyrene is frequently not detected or is found at only very low levels in fish from environments heavily contaminated with PAHs (ATSDR, 1989).

Metals

It is difficult to make generalizations about the toxic actions of metals because of diverse affinities for organic molecules in biologic structures, a wide array of biological effects, and a multiplicity of target organs and systems (Amdur et al., 1991). At the molecular level, metals can manifest toxicity in many ways, including selectively accumulating in target organs (such as the kidneys), substituting for "essential" metals, and mimicking essential substrates (Clarkson, 1983). The reactions of metals at the molecular level typically affect enzyme systems, leading to disruption of cellular transport, cellular respiration, cell division, and other physiological processes. Metal toxicity to aquatic organisms is manifested through a broad spectrum of effects that may range from a reduction in growth rate to death.

Most metals are toxic to terrestrial (i.e., plants, invertebrates, vertebrates) ecological receptors above certain concentrations, with some metals being more toxic at lower concentrations than others. Also, different chemical forms of the metals may be more toxic than others. For example, hexavalent chromium is typically more toxic than trivalent chromium, and methylmercury is more toxic than inorganic mercury. Many factors (e.g., pH, Eh, clay content, organic matter content) influence the bioavailability of metals to invertebrates in soils.

The U. S. EPA Guidance for Developing Ecological Soil Screening Levels (Eco SSLs) (U. S. EPA, 2005) and associated documents were the source of the BAFs for most of the metals. The majority of the BAFs are actually regression equations that are used to calculate the tissue concentration from the soil concentration.

References:

Amdur, M.O., J. Doull C.D. Klassen eds., 1991. Casarett and Doull's Toxicology: The Basic Science of Poisons 3rd edition Macmillan Press New York, New York.

Agency for Toxic Substances and Disease Registry (ATSDR). 1989. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. U.S. Public Health Service. Atlanta, Georgia. October.

Beyer, Nelson. 1990. Evaluating Soil Contamination. U.S. Department of the Interior, Fish and Wildlife Service. Biological Report 90(2). July.

Clarkson, Thomas W, 1983. "Molecular Targets of Metal Toxicity" in Chemical Toxicology and Clinical Chemistry of Metals Academic Press, Inc., Orlando, Florida.

Eisler, Ronald. 1987. Polycyclic Aromatic Hydrocarbon Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. US Department of Interior - Fish and Wildlife Service. Biological Report 85 (1.11). May.

Ma, Wei-Chun, Andre Van Kleunen, Jaap Immerzeel, and P. Gert-Jan de Maagd. 1998. Bioaccumulation of Polycyclic Aromatic Hydrocarbons by Earthworms: Assessment of Equilibrium Partitioning Theory in *In Situ* Studies and Water Experiments. Environmental Toxicology and Chemistry, Vol. 17, No. 9. pp. 1730-1737.

U. S. EPA (U.S. Environmental Protection Agency), 2005. Guidance for Developing Ecological Soil Screening Levels. Office of Solid Waste and Emergency and Response. OSWER Directive 92857-55. February.

TABLE F.1

TOXICITY REFERENCE VALUES FOR TERRESTRIAL FOOR CHAIN MODELS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

PARAMETER	Mammal		Bird	
	NOAEL	LOAEL	NOAEL	LOAEL
SEMIVOLATILES				
Benzo(a)anthracene	0.615	38.4	2	20
Benzo(a)pyrene	0.615	38.4	2	20
Benzo(b)fluoranthene	0.615	38.4	2	20
Benzo(g,h,i)perylene	0.615	38.4	2	20
Benzo(k)fluoranthene	0.615	38.4	2	20
Chrysene	0.615	38.4	2	20
Indeno(1,2,3-cd)pyrene	0.615	38.4	2	20
Pyrene	0.615	38.4	2	20
INORGANICS				
Antimony	0.059	2.76	NV	NV
Cadmium	0.77	6.9	1.47	6.35
Chromium	2.40	58.17	2.66	15.63
Copper	5.6	82.7	4.05	34.87
Lead	4.7	186.4	1.63	44.63
Nickel	1.70	14.77	6.71	18.57
Selenium	0.143	0.66	0.29	0.82
Thallium	0.0074	0.074	NV	NV
Vanadium	4.16	9.44	0.34	1.70
Zinc	75.4	298	66.1	171

Notes:

The sources of these NOAELS and LOAELS are presented in Table F.2 titled "Sources and Endpoints for NOAELS and LOAELS for Terrestrial Wildlife".

The NOAELS and LOAELS in the source table were divided by 10 if a subchronic study was the basis for the value. Also, if only a NOAEL was available, the value was multiplied by 10 to estimate the LOAEL. If only a LOAEL was available, the value was divided by 10 to estimate the NOAEL.

TABLE F.2

SOURCES AND ENDPOINTS FOR NOAELS AND LOAELS FOR TERRESTRIAL WILDLIFE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Parameters	*Concentration* (mg/kg-day)	Endpoint	Effect	Chronic/ Subchronic	Species	Primary Reference	Source of Reference
Semivolatiles Organics							
7,12-Dimethylbenz(a)anthracene	2	NOAEL	systemic	chronic	nestling/starlings	Trust et al., 1994	
7,12-Dimethylbenz(a)anthracene	20	LOAEL	systemic	chronic	nestling/starlings	Trust et al., 1994	
High Molecular Weight PAHs	0.615	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
High Molecular Weight PAHs	38.4	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Inorganics							
Antimony	0.059	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Antimony	2.76	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2006	
Cadmium	1.47	NOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Cadmium	6.35	LOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Cadmium	0.77	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Cadmium	6.9	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Chromium(III)	2.66	NOAEL	reproduction & growth	chronic	birds	USEPA, 2008	
Chromium(III)	15.63	LOAEL	reproduction & growth	chronic	birds	USEPA, 2008	
Chromium(III)	2.4	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2008	
Chromium(III)	58.17	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2008	
Chromium(VI)	5.66	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2008	
Chromium(VI)	38.37	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2008	
Copper	4.05	NOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Copper	34.87	LOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Copper	5.6	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Copper	82.7	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Lead	1.63	NOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Lead	44.6	LOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Lead	4.7	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Lead	186.4	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Nickel	6.71	NOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Nickel	18.57	LOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Nickel	1.7	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Nickel	14.77	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Selenium	0.29	NOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Selenium	0.819	LOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Selenium	0.143	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Selenium	0.661	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Thallium	0.74	LOAEL	reproductive	subchronic	rat	Formigli et al., 1986	Sample et.al., 1996
Vanadium	0.344	NOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Vanadium	1.686	LOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Vanadium	4.16	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Vanadium	9.436	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	

SOURCES AND ENDPOINTS FOR NOAELS AND LOAELS FOR TERRESTRIAL WILDLIFE
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Parameters	Concentration (mg/kg-day)	Endpoint	Effect	Chronic/ Subchronic	Species	Primary Reference	Source of Reference
Zinc	75.4	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Zinc	297.58	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Zinc	66.1	NOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Zinc	171.44	LOAEL	reproduction & growth	chronic	birds	USEPA, 2007	

Notes:

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

The NOAELS and LOAELS for the following PAHs are based on the High Molecular Weight PAH values: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, indeno(1,2,3-c,d)pyrene, and pyrene.

The NOAELS and LOAELS for the PAHs for birds were based on 7,12-dimethylbenz(a)anthracene.

The LOAELs used for several metals were calculated as the geometric mean of growth and reproduction data from the Ecological Soil Screening Levels (U.S. EPA, 2005, 2006, 2007).

References for the NOAELS and LOAELs are presented in this Attachment and Titled "Source and Endpoint References for NOAELs and LOAELs for Terrestrial Wildlife".

Formigli, L., R. Scelsi, P. Poggi, C. Gregotti, A. DiNucci, E. Sabbioni, L. Gottardi, and L. Manzo. 1986. Thallium-Induced Testicular Toxicity in the Rat. Environ. Res. 40:531-539.

Sample, B.E., D.M. Opresko, and G.W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Oak Ridge National Laboratory. June. ES/ER/TM-86/R3.

Trust, K.A., A. Fairbrother, and M.J. Hooper. 1994. Effects of 7,12-Dimethylbenz(a)anthracene on Immune Function and Mixed-Function Oxygenase Activity in the European Starling. Environ. Tox. And Chem., Vol. 13, No. 5, pp. 821-830.

U. S. EPA, 2005. Ecological Soil Screening Level for Antimony, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-61. February.

U. S. EPA, 2005. Ecological Soil Screening Level for Cadmium, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-65. March.

U. S. EPA, 2005. Ecological Soil Screening Level for Lead, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-70. March.

U. S. EPA, 2005. Ecological Soil Screening Level for Vanadium, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-75. April.

U. S. EPA, 2007. Ecological Soil Screening Level for Copper, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-68. February.

U. S. EPA, 2007. Ecological Soil Screening Level for Nickel, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-76. March.

U. S. EPA, 2007. Ecological Soil Screening Level for Selenium, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-72. July.

U. S. EPA, 2007. Ecological Soil Screening Level for Zinc, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-73. June.

SOURCES AND ENPOINTS FOR NOAELS AND LOAELS FOR TERRESTRIAL WILDLIFE

U. S. EPA, 2007. Ecological Soil Screening Level for PAHs, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-78. June.

U. S. EPA, 2008. Ecological Soil Screening Level for Chromium, Interim Final. Office of Emergency and Remedial Response. OSWER Directive 9285.7-66. April.

This appendix presents the bioaccumulation factors (BAFs) that were used in the food chain models, as noted in Table F.3. The following sources of BAFs were used in the ecological risk assessment for most of the chemicals:

- Plant and Soil Invertebrate BAFs: EPA Guidance for Developing Ecological Soil Screening Levels, Attachment 4-1 (U. S. EPA, 2007)

- Plant BAFs (metals): Empirical Model for the Uptake of Inorganic Chemicals from Soil by Plants (ORNL, September 1998).

- Soil Invertebrate BAFs: Development and Validation of Bioaccumulation Models for Earthworms (Sample et al., 1998).

Appendix Table F.3 presents the BAFs that were used in the surrogate species' food-chain models for the individual constituents that were detected in the surface soil at UXO 7. Note that dry weight BAFs were used for this ERA.

The EPA Guidance for Developing Ecological Soil Screening Levels (Eco SSLs) was the source of the BAFs for most of the chemicals. The majority of the BAFs are actually regression equations that are used to calculate the tissue concentration from the soil concentration.

Appendix Table F.4 presents the derivation of the soil to earthworm BAFs for PAHs. The BAFs for the PAHs in the Eco-SSL guidance document are based on equilibrium partitioning. The article on which the BAFs in the Eco-SSL document are based (Jager et al., 2003) indicates that the equilibrium partitioning may overestimate BAFs by up to two orders of magnitude. Two sets of BAF studies were found for PAHs based on empirical data (see Appendix Table F.4). In Ma et al., (1998), BAFs were calculated for PAHs in different soil types and the BAFs were presented as values for total PAHs. The second study, reported in Beyer (1990), presented average soil and earthworm concentrations for individual PAHs. The data were used to calculate the BAFs by dividing the PAH concentrations in the earthworm samples by the PAH concentrations in the soil samples. For the conservative food chain model, 1.606 [the maximum BAF from Ma et al., (1998)] was used while the average BAF of 0.609 was used for the average food chain model. These values were used because they are more conservative than those from Beyer (1990) and were based on more than one study. Although the selected BAFs are about one order of magnitude lower than those in the Eco-SSL document, the BAFs from Ma et al. (1998) were used because they likely provide a more representative assessment of bioaccumulation because they are based on empirical data.

References:

Beyer, W.N. and D.C. Gish. 1980. Persistence in Earthworms and Potential Hazards to Birds of soil Applied DDT, Dieldrin, and Heptachlor. J. Appl. Ecol. 17:295-307. Cited in Beyer, 1990.

Beyer, Nelson. 1990. Evaluating Soil Contamination. U.S. Department of the Interior, Fish and Wildlife Service. Biological Report 90(2). July.

Davis, B.N.K. 1971. Laboratory Studies on the Uptake of Dieldrin and DDT by Earthworms. Soil Biol. Biochem. 3:221-233. Cited in Beyer, 1990.

Jager, T. 1998. Mechanistic Approach for Estimating Bioconcentration of Organic Chemicals in Earthworms. *Environ. Toxicol. Chem.* 17: 2080-2090.

Ma, Wei-Chun, Andre Van Kleunen, Jaap Immerzeel, and P. Gert-Jan de Maagd. 1998. Bioaccumulation of Polycyclic Aromatic Hydrocarbons by Earthworms: Assessment of Equilibrium Partitioning Theory in *In Situ* Studies and Water Experiments. Environmental Toxicology and Chemistry, Vol. 17, No. 9. pp. 1730-1737.

ORNL (Oak Ridge National Laboratory). 1998. Empirical Model for the Uptake of Inorganic Chemicals from Soil by Plants. BJC/OR-133. September.

ORNL. 2008. Toxicity and Chemical-Specific Factors Database. Oak Ridge National Laboratory Web Page, http://risk.lsd.ornl.gov/cgi-bin/tox/TOX_9801.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W., Suter II, and T.L. Ashwood. 1998. Development and Validation of Bioaccumulation Models for Earthworms. Oak Ridge National Laboratory. June. ES/ER/TM-220.

USEPA, 2005. Guidance for Developing Ecological Soil Screening Level. Office of Solid Waste and Emergency and Response. OSWER Directive 92857-55. February.

TABLE F.3

DRY WEIGHT BAFS FOR PLANTS AND EARTHWORMS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Chemicals	Plant BAFs[1]		Earthworm BAFs[1]	
	Conservative[5]	Average[5]	Conservative[5]	Average[5]
Semivolatile Organics				
Benzo(a)anthracene	Eco-SSL	Eco-SSL	1.61E+00 [4]	6.09E-01 [4]
Benzo(a)pyrene	Eco-SSL	Eco-SSL	1.61E+00 [4]	6.09E-01 [4]
Benzo(b)fluoranthene	Eco-SSL	Eco-SSL	1.61E+00 [4]	6.09E-01 [4]
Benzo(g,h,i)perylene	Eco-SSL	Eco-SSL	1.61E+00 [4]	6.09E-01 [4]
Benzo(k)Fluoranthene	Eco-SSL	Eco-SSL	1.61E+00 [4]	6.09E-01 [4]
Chrysene	Eco-SSL	Eco-SSL	1.61E+00 [4]	6.09E-01 [4]
Indeno(1,2,3-cd)pyrene	Eco-SSL	Eco-SSL	1.61E+00 [4]	6.09E-01 [4]
Pyrene	Eco-SSL	Eco-SSL	1.61E+00 [4]	6.09E-01 [4]
Inorganics				
Antimony	0.0114[2]	0.0102[2]	1.00E+00	1.00E+00
Cadmium	Eco-SSL	Eco-SSL	Eco-SSL	Eco-SSL
Chromium	Eco-SSL	Eco-SSL	Eco-SSL	Eco-SSL
Copper	Eco-SSL	Eco-SSL	Eco-SSL	Eco-SSL
Lead	Eco-SSL	Eco-SSL	Eco-SSL	Eco-SSL
Nickel	Eco-SSL	Eco-SSL	4.73E+00 [3]	1.06E+00 [3]
Selenium	Eco-SSL	Eco-SSL	Eco-SSL	Eco-SSL
Thallium	1.00E+00	1.00E+00	1.00E+00	1.00E+00
Vanadium	Eco-SSL	Eco-SSL	Eco-SSL	Eco-SSL
Zinc	Eco-SSL	Eco-SSL	Eco-SSL	Eco-SSL

Notes:
BAF - Bioaccumulation Factor
Eco-SSL - USEPA Ecological Screening Level

1 - Where "Eco-SSL" is given, values were calculated using regression equations or BAFs from USEPA (2007), Attachment 4-1, Tables 4a (inorganics) and 4b (organics).
2 - ORNL, (September, 1998) for inorganics; conservative value is 90th percentile; average value is median value
3 - Sample et al. (February, 1998) (Table 11).
4 - See Appendix Table F.4 for the derivation of the PAH BAFs.
5 - Conservative and average refers to the exposure scenarios for which the uptake factors are used

Default value of 1 is assigned to parameters without uptake factors
References and rationale for the BAFs are provided in this Appendix titled "Bioaccumulation Factor Sources".

TABLE F.4

SOIL TO EARTHWORM BIOACCUMULATION FACTORS FOR PAHS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE, INDIANA

Soil	Wet-Weight BAFs(1)	Dry-Weight BAFs(2)	Soil Type
OT1	0.081	0.506	Silty clay loam
OT2	0.026	0.163	Light sandy loam
OT3	0.105	0.656	Silty clay loam
OT4	0.257	1.606	Silty clay loam
OT5	0.192	1.200	Silty clay loam
OT6	0.091	0.569	Silty clay loam
GP1	0.069	0.431	Silty clay loam
GP2	0.072	0.450	Silty clay loam
GP3	0.062	0.388	Silty clay loam
GP4	0.11	0.688	Silty clay
GP5	0.042	0.263	Silty clay
GP6	0.062	0.388	Silty clay
Minimum BAF	**0.026**	**0.163**	
Maximum BAF	**0.257**	**1.606**	
Average BAF	**0.097**	**0.609**	

Notes:
Source of data is Ma et al., (1998)
1 - BAFs from the study are based on wet weight and normalized to the percent of organic carbon and percent lipids.
2 - These BAFs were calculated by dividing the wet weight BAF by 0.16 (percent solids of an earthworm)

	Earthworm Bioaccuumulation Factors(1)			
Chemical	**Soil Concentration (mg/kg)**	**Earthworm Concentration (mg/kg)**	**BAF (dry weight)**	**BAF (wet weight)(2)**
Acenaphthylene	ND	ND	ND	ND
Anthanthrene	1.2	0.11	0.092	0.015
Anthracene	0.92	0.047	0.051	0.008
Benzo(a)anthracene	2	0.25	0.13	0.020
Benzo(a)pyrene	3.8	1.3	0.34	0.055
Benzo(b)fluoranthene	2.6	0.83	0.32	0.051
Benzo(e)pryene	2.1	0.91	0.43	0.069
Benzo(g,h,i)perylene	4.5	1.1	0.24	0.039
Benzo(k)fluoranthene	1.5	0.38	0.25	0.041
Chrysene	2	0.35	0.18	0.028
Dibenzo(a,i)pyrene	1.4	0.44	0.31	0.050
Dibenzo(a,j)anthracene	0.87	0.32	0.37	0.059
Fluoranthene	2.4	0.19	0.079	0.013
Fluorene	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	3.1	1.3	0.42	0.067
Naphthalene	ND	ND	ND	ND
Perylene	1.2	0.3	0.25	0.040
Phenanthrene	2.3	0.28	0.12	0.019
Pyrene	2.5	0.23	0.092	0.015
Triphenylene	1.3	0.87	0.67	0.107
		Minimum BAF	**0.051**	**0.0082**
		Maximum BAF	**0.669**	**0.107**
		Average BAF	**0.256**	**0.041**

Notes:
ND = No data available
1 - Source of data is Table 25 in Beyer (1990)
2 - Wet weight BAF was calculated by multiplying the dry weight BAF by 0.16 (percent solids of an earthworm)

The following sections present the receptor profiles for the representative herbivorous, insectivorous, and piscivorous receptors chosen for food chain modeling at UXO 7. The majority of the information for the profiles was obtained from the Wildlife Exposure Factors Handbook (U.S. EPA, 1993). The data for the incidental soil ingestion rates were obtained from the U.S. EPA Ecological Soil Screening Guidance (U.S. EPA, 2005).

The food and water ingestion rates are listed in g/g (of body weight)-day on a wet weight basis but were converted to dry weight for the ERA using the exposure factors presented below. The home ranges are presented in hectares in U.S. EPA (1993) but were converted to acres by multiplying the number of hectares by 2.471. Also note that the estimated percent of soil in the diets are listed in dry weight.

Short-Tailed Shrew (*Blarina brevicauda*)

Shrews inhabit a wide variety of habitats and are common in areas with abundant vegetative cover. They need cool, moist habitats because of their high metabolic and water-loss rates. The short-tailed shrew is primarily carnivorous, eating insects and other invertebrates such as earthworms, slugs, and snails.

The adult body weight for the short-tailed shrew in various habitats ranged from 0.015 to 0.01921 kg with an average of 0.0169 kg. The listed food ingestion rates for shrews are between 0.43 and 0.96 g/g-day (wet-weight). The food ingestion rate in kg/day was calculated as shown on Table F.5. The food ingestion rate was then multiplied by 0.16 in the food chain model, which is the percent solids of worms (Sample et al., 1997) to convert the ingestion rate from a wet-weight value to a dry-weight value. The incidental soil ingestion rate was calculated by multiplying the ingestion rate by the percentage of soil that is incidentally ingested (3% for conservative food chain model and 0.9% for the average food chain model) from U. S. EPA (2007). 3% is the 90^{th} percentile value and 0.9% is the 50^{th} percentile value from U. S. EPA (2007). The only available home range for the shrew (0. 9699 acres) was calculated using data from a tamarack bog in Manitoba (only value available).

American Woodcock (*Scolopax minor*)

Woodcocks inhabit both woodlands and abandoned fields, particularly those with rich and moderately to poorly drained loamy soils, which tend to support abundant earthworm populations. They feed primarily on invertebrates found in moist upland soils by probing the soil with their long prehensile-tipped bill. Earthworms are their preferred diet, but seeds and other plant matter may also be consumed.

The adult body weight for the woodcock ranges from 0.166 to 0.213 kg with an average of 0.190 kg. The listed food ingestion rates for the woodcock are between 0.73 and 1.0 g/g-day (wet-weight). The food ingestion rate in kg/day was calculated as shown in Table F.5. The food ingestion rate was then multiplied by 0.16 in the food chain model, which is the percent solids of worms (Sample et al., 1997) to convert the ingestion rate from a wet-weight value to a dry-weight value. The incidental soil ingestion rate was calculated by multiplying the ingestion rate by the percentage of soil that is incidentally ingested (assumed 16.4% for conservative food chain model and 6.4% for the average food chain model) from U. S. EPA (2007). 16.4% is the 90th percentile value and 6.4% is the 50th percentile value from U. S. EPA (2007).

The range of home range sizes for the woodcock is 7.66 to 182 acres with an average home range of 61 acres.

Meadow Vole (*Microtus pennsylvanicus*)

Meadow voles inhabit grassy fields, marshes, and bogs; however, they prefer fields with more grass, more cover, and fewer woody plants. They typically consume green succulent vegetation, sedges, seeds, roots, bark, fungi, insects, and animal matter. However, green succulent vegetation makes up the majority of their diet.

The adult body weight for the vole ranges from 0.0329 to 0.0391 kg with an average of 0.0366 kg. The only listed food ingestion rates for voles range from 0.30 to 0.35 g/g-day (wet-weight), with an average of 0.325 g/g-day. The food ingestion rate in kg/day was calculated as shown in Table F.5. The food ingestion rate was then multiplied by 0.15 in the food chain model, which is the percent solids of plant foliage (U.S. EPA, 2007), to convert the ingestion rate from a wet-weight value to a dry-weight value. The incidental soil ingestion rate was calculated by multiplying the ingestion rate by the percentage of soil that is incidentally ingested (assumed 3.2% for conservative food chain model and 1.2% for the average food chain model) from U. S. EPA (2007). 3.2% is the 90th percentile value and 1.2% is the 50th percentile value from U. S. EPA (2007).

The range of home range sizes for the meadow vole is 0.0297 to 1.06 acres with an average home range of 0.16 acres.

Northern Bobwhite Quail (*Colinus virginianus*)

Quails inhabit grasslands, idle fields, pastures, and large clumps of grasses. Bobwhite quails forage in areas with open vegetation, some bare ground, and light litter. Seeds from weeds, woody plants, and grasses comprise the majority of an adult's diet, although green vegetation has been found to dominate the diet of this species in winter in the southern areas of the United States.

The adult body weight for the bobwhite quail ranges from 0.162 to 0.186 kg with an average of 0.177 kg. The listed food ingestion rates for quails range from 0.067 to 0.093 g/g-day (wet-weight), with an average of 0.082 g/g-day. The food ingestion rate in kg/day was calculated as shown on Table F.5. The food ingestion rate was then multiplied by 0.15 in the food chain model, which is the percent solids of plant foliage (U.S. EPA, 2007), to convert the ingestion rate from a wet-weight value to a dry-weight value. The incidental soil ingestion rate was calculated by multiplying the ingestion rate by the percentage of soil that is incidentally ingested (assumed 13.9% for conservative food chain model and 6.1% for the average food chain model) from U. S. EPA (2007). 13.9% is the 90th percentile value and 6.1% is the 50th percentile value for the mourning dove from U. S. EPA (2007).

The home range for the quail ranges from 16 to 41 acres with an average home range of 29 acres.

References:

Sample, B.E., M.S. Aplin, R.A. Efroymson, G.W., Suter II, and C.J.E. Welsh. 1997. Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants. Oak Ridge National Laboratory. October. ORNL/TM-13391.

U.S. EPA (U.S. Environmental Protection Agency), 1993. Wildlife Exposure Factors Handbook. U.S. Environmental Protection Agency. Office of Research and Development. Washington, D.C. December 1993. EPA/600/R-93/187a.

U.S. EPA (U.S. Environmental Protection Agency), 2007. Guidance for Developing Ecological Soil Screening Level, Attachment 4-1, Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. Office of Solid Waste and Emergency and Response. OSWER Directive 9285.7-55. April.

TABLE F.5

CALCULATION OF EXPOSURE PARAMETERS FOR SURROGATE WILDLIFE RECEPTORS
UXO 7 - RFI REPORT
NSWC CRANE
CRANE INDIANA

Exposure Parameters	Meadow Vole		Short-Tailed Shrew		American Woodcock	Bobwhite Quail	
Body Weights (g)	32.9		17.61	16.87	168	180	181
	39.1		17.33	15.58	209	168	183
	35.5		19.21	15.7	166	162	179
	39		17.4	15.25	212	175	175
					169	178	183.2
					213	179	185.5
						180	173
						162.8	180.4
Minimum	***32.9***		***15.25***		***166***	***162***	
Maximum	***39.1***		***19.21***		***213***	***186***	
Average	***36.6***		***16.87***		***190***	***177***	
Food Ingestion Rate (g/g-day) (1)	0.3		0.49	0.77	1.0	0.067	0.079
	0.35		0.62	0.55	0.77	0.072	0.093
			0.43	0.96	0.73	0.09	0.089
			0.52	0.54			
Minimum	***0.3***		***0.43***		***0.73***	***0.067***	
Maximum	***0.35***		***0.96***		***1.0***	***0.093***	
Average	***0.325***		***0.61***		***0.8***	***0.082***	
Food Ingestion Rate (kg/day)							
Conservative	***1.28E-02***		***1.62E-02***		***1.90E-01***	***1.64E-02***	
Average	***1.19E-02***		***1.03E-02***		***1.58E-01***	***1.44E-02***	
Home Range (Ha)	0.43	0.097	0.3925		4.5	7.6	
	0.019	0.041			32.4	16.7	
	0.013	0.033			3.1	6.4	
	0.012	0.013			73.6	15.6	
	0.043	0.057			10.5		
	0.023	0.032					
	0.051	0.078					
	0.058	0.061					
Minimum (acres)	***0.0297***		***0.97***		***7.7***	***16***	
Maximum (acres)	***1.06***		***0.97***		***182***	***41***	
Average (acres)	***0.16***		***0.97***		***61***	***29***	

Notes:
Source of data is U.S. EPA (1993). If values from several studies are available, they are given. The minimum, maximum, and average values are derived from these studies.

Footnotes:
(1) - Ingestion Rates (kg/day or L/day) (if more than 1 ingestion rate is available)
- Conservative value = Max Ingestion Rate (g/g-day) * Avg. Body Weight
- Average value = Avg. Ingestion Rate (g/g-day) * Avg. Body Weight

Ingestion Rates (L/day) (if only 1 ingestion rate is available)
- Conservative value = Ingestion Rate (g/g-day) * Max. Body Weight
- Average value = Ingestion Rate (g/g-day) * Avg. Body Weight

APPENDIX F

CHEMICAL CONCENTRATIONS IN SURFACE SOIL AND TISSUE
NORTHERN ZONE - UXO 7
NSWC CRANE
CRANE, INDIANA

Chemical	Surface Soil Concentrations (mg/kg)				Earthworm Bioaccumulation Factors		Earthworm Concentrations (mg/kg)		Plant Bioaccumulation Factors		Plant Concentrations (mg/kg)	
	Maximum Detection	Average All	Average of Positive Detections	Average (1)	Conservative	Average	Maximum Detection	Average	Conservative	Average	Maximum Detection	Average
Inorganics												
ANTIMONY	9.62E+01	1.17E+01	1.31E+01	1.17E+01	1.00E+00	1.00E+00	9.62E+01	1.17E+01	1.14E-02	1.02E-02	1.10E+00	1.19E-01
CADMIUM	2.21E+00	1.03E+00	1.03E+00	1.03E+00	Regression or BAF from Eco SSL		1.56E+01	8.51E+00	Regression or BAF from Eco SSL		9.59E-01	6.33E-01
CHROMIUM	5.70E+01	2.78E+01	2.78E+01	2.78E+01	Regression or BAF from Eco SSL		1.74E+01	8.52E+00	Regression or BAF from Eco SSL		2.34E+00	1.14E+00
COPPER	2.83E+02	8.13E+01	8.13E+01	8.13E+01	Regression or BAF from Eco SSL		1.46E+02	4.19E+01	Regression or BAF from Eco SSL		1.80E+01	1.10E+01
LEAD, LABEQV	1.16E+03	1.82E+02	1.99E+02	1.82E+02	Regression or BAF from Eco SSL		2.39E+02	5.37E+01	Regression or BAF from Eco SSL		1.39E+01	4.92E+00
THALLIUM	5.25E-01	2.13E-01	2.22E-01	2.13E-01	1.00E+00	1.00E+00	5.25E-01	2.13E-01	1.00E+00	1.00E+00	5.25E-01	2.13E-01
VANADIUM	8.59E+01	4.47E+01	4.47E+01	4.47E+01	Regression or BAF from Eco SSL		3.61E+00	1.88E+00	Regression or BAF from Eco SSL		4.17E-01	2.17E-01
ZINC	1.18E+02	6.66E+01	6.66E+01	6.66E+01	Regression or BAF from Eco SSL		4.09E+02	3.39E+02	Regression or BAF from Eco SSL		6.79E+01	4.94E+01

1 - If the average of all value is the greater than the maximum detection, the average of the positive detections was used as the average value.

MEADOW VOLE - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
NORTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Max Soil Concentration (mg/kg)	Max SW Concentration (mg/L)	Vegetation Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Vegetation	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics											
ANTIMONY	9.62E+01	0.00E+00	1.10E+00	3.59E-01	0.00E+00	1.28E-01	4.87E-01	5.90E-02	2.76E+00	8.26E+00	1.77E-01
CADMIUM	2.21E+00	0.00E+00	9.59E-01	8.25E-03	0.00E+00	1.12E-01	1.20E-01	7.70E-01	6.90E+00	1.56E-01	1.74E-02
CHROMIUM	5.70E+01	0.00E+00	2.34E+00	2.13E-01	0.00E+00	2.73E-01	4.86E-01	2.40E+00	5.82E+01	2.02E-01	8.35E-03
COPPER	2.83E+02	0.00E+00	1.80E+01	1.06E+00	0.00E+00	2.10E+00	3.16E+00	5.60E+00	8.27E+01	5.65E-01	3.82E-02
LEAD	1.16E+03	0.00E+00	1.39E+01	4.33E+00	0.00E+00	1.62E+00	5.95E+00	4.70E+00	1.86E+02	1.27E+00	3.19E-02
THALLIUM	5.25E-01	0.00E+00	5.25E-01	1.96E-03	0.00E+00	6.13E-02	6.32E-02	7.40E-03	7.40E-02	8.55E+00	8.55E-01
VANADIUM	8.59E+01	0.00E+00	4.17E-01	3.21E-01	0.00E+00	4.86E-02	3.69E-01	4.16E+00	9.44E+00	8.88E-02	3.91E-02
ZINC	1.18E+02	0.00E+00	6.79E+01	4.41E-01	0.00E+00	7.92E+00	8.37E+00	7.54E+01	2.98E+02	1.11E-01	2.81E-02

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	3.290E-02	kg
Food Ingestion Rate = (If)	3.840E-03	kg/day
Water Ingestion Rate = (Iw)	7.700E-03	L/day
Soil Ingestion Rate = (Is)	1.229E-04	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

<u>Definitions:</u>
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Cv = Contaminant conc. in vegetation (=soil conc. * Biotransfer Factor)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (vegetation)

MEADOW VOLE - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
NORTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Avg Soil Concentration (mg/kg)	Avg SW Concentration (mg/L)	Vegetation Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Dose (mg/kg/day) from: Surface Water	Dose (mg/kg/day) from: Vegetation	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics											
ANTIMONY	1.17E+01	0.00E+00	1.19E-01	1.37E-02	0.00E+00	1.16E-02	2.53E-02	5.90E-02	2.76E+00	4.29E-01	9.18E-03
CADMIUM	1.03E+00	0.00E+00	6.33E-01	1.21E-03	0.00E+00	6.17E-02	6.29E-02	7.70E-01	6.90E+00	8.18E-02	9.12E-03
CHROMIUM	2.78E+01	0.00E+00	1.14E+00	3.25E-02	0.00E+00	1.11E-01	1.44E-01	2.40E+00	5.82E+01	5.98E-02	2.47E-03
COPPER	8.13E+01	0.00E+00	1.10E+01	9.51E-02	0.00E+00	1.08E+00	1.17E+00	5.60E+00	8.27E+01	2.09E-01	1.42E-02
LEAD	1.82E+02	0.00E+00	4.92E+00	2.13E-01	0.00E+00	4.79E-01	6.92E-01	4.70E+00	1.86E+02	1.47E-01	3.71E-03
THALLIUM	2.13E-01	0.00E+00	2.13E-01	2.49E-04	0.00E+00	2.07E-02	2.10E-02	7.40E-03	7.40E-02	2.84E+00	2.84E-01
VANADIUM	4.47E+01	0.00E+00	2.17E-01	5.23E-02	0.00E+00	2.11E-02	7.34E-02	4.16E+00	9.44E+00	1.77E-02	7.78E-03
ZINC	6.66E+01	0.00E+00	4.94E+01	7.79E-02	0.00E+00	4.82E+00	4.90E+00	7.54E+01	2.98E+02	6.49E-02	1.64E-02

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	3.663E-02	kg
Food Ingestion Rate = (If)	3.570E-03	kg/day
Water Ingestion Rate = (Iw)	6.400E-03	L/day
Soil Ingestion Rate = (Is)	4.284E-05	kg/day
Home Range = (HR)	1.640E-01	acres
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Cv = Contaminant conc. in vegetation (=soil conc. * Biotransfer Factor)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (vegetation)

BOBWHITE QUAIL - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
NORTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Max Soil Concentration (mg/kg)	Max SW Concentration (mg/L)	Vegetation Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Vegetation	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics											
ANTIMONY	9.62E+01	0.00E+00	1.10E+00	4.06E-01	0.00E+00	3.33E-02	4.39E-01	NV	NV	#VALUE!	#VALUE!
CADMIUM	2.21E+00	0.00E+00	9.59E-01	9.33E-03	0.00E+00	2.91E-02	3.84E-02	1.47E+00	6.35E+00	2.62E-02	6.06E-03
CHROMIUM	5.70E+01	0.00E+00	2.34E+00	2.41E-01	0.00E+00	7.10E-02	3.12E-01	2.66E+00	1.56E+01	1.17E-01	1.99E-02
COPPER	2.83E+02	0.00E+00	1.80E+01	1.19E+00	0.00E+00	5.48E-01	1.74E+00	4.05E+00	3.49E+01	4.30E-01	5.00E-02
LEAD	1.16E+03	0.00E+00	1.39E+01	4.90E+00	0.00E+00	4.22E-01	5.32E+00	1.63E+00	4.46E+01	3.26E+00	1.19E-01
THALLIUM	5.25E-01	0.00E+00	5.25E-01	2.22E-03	0.00E+00	1.59E-02	1.82E-02	NV	NV	#VALUE!	#VALUE!
VANADIUM	8.59E+01	0.00E+00	4.17E-01	3.63E-01	0.00E+00	1.27E-02	3.75E-01	3.44E-01	1.70E+00	1.09E+00	2.21E-01
ZINC	1.18E+02	0.00E+00	6.79E+01	4.98E-01	0.00E+00	2.06E+00	2.56E+00	6.61E+01	1.71E+02	3.87E-02	1.50E-02

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.620E-01	kg
Food Ingestion Rate = (If)	4.920E-03	kg/day
Water Ingestion Rate = (Iw)	2.310E-02	L/day
Soil Ingestion Rate = (Is)	6.839E-04	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Cv = Contaminant conc. in vegetation (=soil conc. * Biotransfer Factor)
#VALUE! = Value not able to be calculated

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (vegetation)

BOBWHITE QUAIL - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
NORTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Avg Soil Concentration (mg/kg)	Avg SW Concentration (mg/L)	Vegetation Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Vegetation	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics											
ANTIMONY	1.17E+01	0.00E+00	1.19E-01	1.74E-02	0.00E+00	2.91E-03	2.03E-02	NV	NV	#VALUE!	#VALUE!
CADMIUM	1.03E+00	0.00E+00	6.33E-01	1.54E-03	0.00E+00	1.55E-02	1.70E-02	1.47E+00	6.35E+00	1.16E-02	2.68E-03
CHROMIUM	2.78E+01	0.00E+00	1.14E+00	4.14E-02	0.00E+00	2.78E-02	6.93E-02	2.66E+00	1.56E+01	2.61E-02	4.43E-03
COPPER	8.13E+01	0.00E+00	1.10E+01	1.21E-01	0.00E+00	2.69E-01	3.90E-01	4.05E+00	3.49E+01	9.64E-02	1.12E-02
LEAD	1.82E+02	0.00E+00	4.92E+00	2.71E-01	0.00E+00	1.20E-01	3.91E-01	1.63E+00	4.46E+01	2.40E-01	8.77E-03
THALLIUM	2.13E-01	0.00E+00	2.13E-01	3.17E-04	0.00E+00	5.20E-03	5.51E-03	NV	NV	#VALUE!	#VALUE!
VANADIUM	4.47E+01	0.00E+00	2.17E-01	6.66E-02	0.00E+00	5.29E-03	7.19E-02	3.44E-01	1.70E+00	2.09E-01	4.23E-02
ZINC	6.66E+01	0.00E+00	4.94E+01	9.91E-02	0.00E+00	1.21E+00	1.31E+00	6.61E+01	1.71E+02	1.98E-02	7.64E-03

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.770E-01	kg
Food Ingestion Rate = (If)	4.320E-03	kg/day
Water Ingestion Rate = (Iw)	1.840E-02	L/day
Soil Ingestion Rate = (Is)	2.635E-04	kg/day
Home Range = (HR)	2.860E+01	acres
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Cv = Contaminant conc. in vegetation (=soil conc. * Biotransfer Factor)
#VALUE! = Value not able to be calculated

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (vegetation)

SHORT-TAILED SHREW - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
NORTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Max Soil Concentration (mg/kg)	Max SW Concentration (mg/L)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Inverts.	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics											
ANTIMONY	9.62E+01	0.00E+00	9.62E+01	4.91E-01	0.00E+00	1.64E+01	1.68E+01	5.90E-02	2.76E+00	2.85E+02	6.10E+00
CADMIUM	2.21E+00	0.00E+00	1.56E+01	1.13E-02	0.00E+00	2.64E+00	2.66E+00	7.70E-01	6.90E+00	3.45E+00	3.85E-01
CHROMIUM	5.70E+01	0.00E+00	1.74E+01	2.91E-01	0.00E+00	2.96E+00	3.26E+00	2.40E+00	5.82E+01	1.35E+00	5.60E-02
COPPER	2.83E+02	0.00E+00	1.46E+02	1.44E+00	0.00E+00	2.48E+01	2.62E+01	5.60E+00	8.27E+01	4.68E+00	3.17E-01
LEAD	1.16E+03	0.00E+00	2.39E+02	5.91E+00	0.00E+00	4.06E+01	4.65E+01	4.70E+00	1.86E+02	9.90E+00	2.50E-01
THALLIUM	5.25E-01	0.00E+00	5.25E-01	2.68E-03	0.00E+00	8.92E-02	9.19E-02	7.40E-03	7.40E-02	1.24E+01	1.24E+00
VANADIUM	8.59E+01	0.00E+00	3.61E+00	4.38E-01	0.00E+00	6.13E-01	1.05E+00	4.16E+00	9.44E+00	2.53E-01	1.11E-01
ZINC	1.18E+02	0.00E+00	4.09E+02	6.02E-01	0.00E+00	6.95E+01	7.01E+01	7.54E+01	2.98E+02	9.30E-01	2.35E-01

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.525E-02	kg
Food Ingestion Rate = (If)	2.592E-03	kg/day
Water Ingestion Rate = (Iw)	4.300E-03	L/day
Soil Ingestion Rate = (Is)	7.776E-05	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (invertebrates) = (Ci * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (invertebrates)

SHORT-TAILED SHREW - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
NORTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Avg Soil Concentration (mg/kg)	Avg SW Concentration (mg/L)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Inverts.	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics											
ANTIMONY	1.17E+01	0.00E+00	1.17E+01	1.03E-02	0.00E+00	1.14E+00	1.15E+00	5.90E-02	2.76E+00	1.96E+01	4.18E-01
CADMIUM	1.03E+00	0.00E+00	8.51E+00	9.09E-04	0.00E+00	8.31E-01	8.32E-01	7.70E-01	6.90E+00	1.08E+00	1.21E-01
CHROMIUM	2.78E+01	0.00E+00	8.52E+00	2.45E-02	0.00E+00	8.32E-01	8.56E-01	2.40E+00	5.82E+01	3.56E-01	1.47E-02
COPPER	8.13E+01	0.00E+00	4.19E+01	7.15E-02	0.00E+00	4.09E+00	4.16E+00	5.60E+00	8.27E+01	7.43E-01	5.03E-02
LEAD	1.82E+02	0.00E+00	5.37E+01	1.60E-01	0.00E+00	5.24E+00	5.40E+00	4.70E+00	1.86E+02	1.15E+00	2.90E-02
THALLIUM	2.13E-01	0.00E+00	2.13E-01	1.87E-04	0.00E+00	2.08E-02	2.10E-02	7.40E-03	7.40E-02	2.84E+00	2.84E-01
VANADIUM	4.47E+01	0.00E+00	1.88E+00	3.93E-02	0.00E+00	1.83E-01	2.23E-01	4.16E+00	9.44E+00	5.36E-02	2.36E-02
ZINC	6.66E+01	0.00E+00	3.39E+02	5.85E-02	0.00E+00	3.31E+01	3.32E+01	7.54E+01	2.98E+02	4.40E-01	1.11E-01

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.687E-02	kg
Food Ingestion Rate = (If)	1.648E-03	kg/day
Water Ingestion Rate = (Iw)	3.800E-03	L/day
Soil Ingestion Rate = (Is)	1.483E-05	kg/day
Home Range = (HR)	9.700E-01	acres
Contaminated Area = (CA)	Assume equal to home range	
H=HR/CA (Assume = to 1 for maximum exposure)		

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (invertebrates) = (Ci * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (invertebrates)

AMERICAN WOODCOCK - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
NORTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Max Soil Concentration (mg/kg)	Max SW Concentration (mg/L)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Inverts.	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics											
ANTIMONY	9.62E+01	0.00E+00	9.62E+01	2.88E+00	0.00E+00	1.76E+01	2.05E+01	NV	NV	#VALUE!	#VALUE!
CADMIUM	2.21E+00	0.00E+00	1.56E+01	6.62E-02	0.00E+00	2.84E+00	2.91E+00	1.47E+00	6.35E+00	1.98E+00	4.58E-01
CHROMIUM	5.70E+01	0.00E+00	1.74E+01	1.71E+00	0.00E+00	3.19E+00	4.89E+00	2.66E+00	1.56E+01	1.84E+00	3.13E-01
COPPER	2.83E+02	0.00E+00	1.46E+02	8.48E+00	0.00E+00	2.66E+01	3.51E+01	4.05E+00	3.49E+01	8.67E+00	1.01E+00
LEAD	1.16E+03	0.00E+00	2.39E+02	3.47E+01	0.00E+00	4.36E+01	7.84E+01	1.63E+00	4.46E+01	4.81E+01	1.76E+00
THALLIUM	5.25E-01	0.00E+00	5.25E-01	1.57E-02	0.00E+00	9.59E-02	1.12E-01	NV	NV	#VALUE!	#VALUE!
VANADIUM	8.59E+01	0.00E+00	3.61E+00	2.57E+00	0.00E+00	6.59E-01	3.23E+00	3.44E-01	1.70E+00	9.40E+00	1.90E+00
ZINC	1.18E+02	0.00E+00	4.09E+02	3.53E+00	0.00E+00	7.47E+01	7.82E+01	6.61E+01	1.71E+02	1.18E+00	4.58E-01

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.660E-01	kg
Food Ingestion Rate = (If)	3.032E-02	kg/day
Water Ingestion Rate = (Iw)	1.900E-02	L/day
Soil Ingestion Rate = (Is)	4.972E-03	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)
#VALUE! = Value not able to be calculated

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (invertebrates) = (Ci * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (invertebrates)

AMERICAN WOODCOCK - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
NORTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Avg Soil Concentration (mg/kg)	Avg SW Concentration (mg/L)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Inverts.	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics											
ANTIMONY	1.17E+01	0.00E+00	1.17E+01	9.99E-02	0.00E+00	1.56E+00	1.66E+00	NV	NV	#VALUE!	#VALUE!
CADMIUM	1.03E+00	0.00E+00	8.51E+00	8.83E-03	0.00E+00	1.13E+00	1.14E+00	1.47E+00	6.35E+00	7.79E-01	1.80E-01
CHROMIUM	2.78E+01	0.00E+00	8.52E+00	2.37E-01	0.00E+00	1.14E+00	1.37E+00	2.66E+00	1.56E+01	5.17E-01	8.78E-02
COPPER	8.13E+01	0.00E+00	4.19E+01	6.94E-01	0.00E+00	5.58E+00	6.28E+00	4.05E+00	3.49E+01	1.55E+00	1.80E-01
LEAD	1.82E+02	0.00E+00	5.37E+01	1.56E+00	0.00E+00	7.16E+00	8.71E+00	1.63E+00	4.46E+01	5.34E+00	1.95E-01
THALLIUM	2.13E-01	0.00E+00	2.13E-01	1.82E-03	0.00E+00	2.84E-02	3.02E-02	NV	NV	#VALUE!	#VALUE!
VANADIUM	4.47E+01	0.00E+00	1.88E+00	3.82E-01	0.00E+00	2.50E-01	6.32E-01	3.44E-01	1.70E+00	1.84E+00	3.72E-01
ZINC	6.66E+01	0.00E+00	3.39E+02	5.68E-01	0.00E+00	4.52E+01	4.58E+01	6.61E+01	1.71E+02	6.92E-01	2.68E-01

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.895E-01	kg
Food Ingestion Rate = (If)	2.526E-02	kg/day
Water Ingestion Rate = (Iw)	1.900E-02	L/day
Soil Ingestion Rate = (Is)	1.617E-03	kg/day
Home Range = (HR)	6.133E+01	acres
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)
#VALUE! = Value not able to be calculated

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (invertebrates) = (Ci * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (invertebrates)

APPENDIX F

CHEMICAL CONCENTRATIONS IN SURFACE SOIL AND TISSUE
CENTRAL ZONE - UXO 7
NSWC CRANE
CRANE, INDIANA

Chemical	Surface Soil Concentrations (mg/kg)				Earthworm Bioaccumulation Factors		Earthworm Concentrations (mg/kg)		Plant Bioaccumulation Factors		Plant Concentrations (mg/kg)	
	Maximum Detection	Average All	Average of Positive Detections	Average [1]	Conservative	Average	Maximum Detection	Average	Conservative	Average	Maximum Detection	Average
Semivolatile Organics												
BENZO(A)ANTHRACENE	6.40E+00	7.69E-01	1.21E+00	7.69E-01	1.61E+00	6.09E-01	1.03E+01	4.68E-01	Regression or BAF from Eco SSL		2.01E-01	5.70E-02
BENZO(A)PYRENE	8.10E+00	9.89E-01	1.55E+00	9.89E-01	1.61E+00	6.09E-01	1.30E+01	6.02E-01	Regression or BAF from Eco SSL		9.78E-01	1.26E-01
BENZO(B)FLUORANTHENE	1.20E+01	1.50E+00	2.36E+00	1.50E+00	1.61E+00	6.09E-01	1.93E+01	9.13E-01	Regression or BAF from Eco SSL		3.72E+00	4.65E-01
BENZO(G,H,I)PERYLENE	2.90E+00	3.70E-01	5.81E-01	3.70E-01	1.61E+00	6.09E-01	4.66E+00	2.25E-01	Regression or BAF from Eco SSL		1.39E+00	1.22E-01
BENZO(K)FLUORANTHENE	4.70E+00	5.66E-01	8.89E-01	5.66E-01	1.61E+00	6.09E-01	7.55E+00	3.45E-01	Regression or BAF from Eco SSL		4.37E-01	7.09E-02
CHRYSENE	7.40E+00	8.99E-01	1.41E+00	8.99E-01	1.61E+00	6.09E-01	1.19E+01	5.48E-01	Regression or BAF from Eco SSL		2.19E-01	6.26E-02
INDENO(1,2,3-CD)PYRENE	2.90E+00	3.65E-01	5.73E-01	3.65E-01	1.61E+00	6.09E-01	4.66E+00	2.22E-01	Regression or BAF from Eco SSL		3.19E-01	4.01E-02
PYRENE	1.40E+01	1.66E+00	2.28E+00	1.66E+00	1.61E+00	6.09E-01	2.25E+01	1.01E+00	Regression or BAF from Eco SSL		1.01E+01	1.19E+00
Inorganics												
ANTIMONY	9.30E-01	5.83E-01	5.83E-01	5.83E-01	1.00E+00	1.00E+00	9.30E-01	5.83E-01	1.14E-02	1.02E-02	1.06E-02	5.95E-03
CADMIUM	1.43E+00	1.07E+00	1.07E+00	1.07E+00	Regression or BAF from Eco SSL		1.10E+01	8.74E+00	Regression or BAF from Eco SSL		7.56E-01	6.46E-01
LEAD, LABEQV	9.94E+01	2.42E+01	3.01E+01	2.42E+01	Regression or BAF from Eco SSL		3.29E+01	1.05E+01	Regression or BAF from Eco SSL		3.50E+00	1.58E+00
VANADIUM	3.81E+01	3.03E+01	3.03E+01	3.03E+01	Regression or BAF from Eco SSL		1.60E+00	1.27E+00	Regression or BAF from Eco SSL		1.85E-01	1.47E-01
ZINC	6.44E+01	5.28E+01	5.28E+01	5.28E+01	Regression or BAF from Eco SSL		3.35E+02	3.14E+02	Regression or BAF from Eco SSL		4.85E+01	4.35E+01

1 - If the average of all value is the greater than the maximum detection, the average of the positive detections was used as the average value.

MEADOW VOLE - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
CENTRAL ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Max Soil Concentration (mg/kg)	Max SW Concentration (mg/L)	Vegetation Concentration (mg/kg)	Dose (mg/kg/day) from:			Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
				Surface Soil	Surface Water	Vegetation					
Semivolatile Organics											
BENZO(A)ANTHRACENE	6.40E+00	0.00E+00	2.01E-01	2.39E-02	0.00E+00	2.35E-02	4.74E-02	6.15E-01	3.84E+01	7.70E-02	1.23E-03
BENZO(A)PYRENE	8.10E+00	0.00E+00	9.78E-01	3.03E-02	0.00E+00	1.14E-01	1.44E-01	6.15E-01	3.84E+01	2.35E-01	3.76E-03
BENZO(B)FLUORANTHENE	1.20E+01	0.00E+00	3.72E+00	4.48E-02	0.00E+00	4.34E-01	4.79E-01	6.15E-01	3.84E+01	7.79E-01	1.25E-02
BENZO(G,H,I)PERYLENE	2.90E+00	0.00E+00	1.39E+00	1.08E-02	0.00E+00	1.62E-01	1.73E-01	6.15E-01	3.84E+01	2.81E-01	4.50E-03
BENZO(K)FLUORANTHENE	4.70E+00	0.00E+00	4.37E-01	1.76E-02	0.00E+00	5.10E-02	6.86E-02	6.15E-01	3.84E+01	1.11E-01	1.79E-03
CHRYSENE	7.40E+00	0.00E+00	2.19E-01	2.76E-02	0.00E+00	2.56E-02	5.32E-02	6.15E-01	3.84E+01	8.65E-02	1.39E-03
INDENO(1,2,3-CD)PYRENE	2.90E+00	0.00E+00	3.19E-01	1.08E-02	0.00E+00	3.72E-02	4.81E-02	6.15E-01	3.84E+01	7.82E-02	1.25E-03
PYRENE	1.40E+01	0.00E+00	1.01E+01	5.23E-02	0.00E+00	1.18E+00	1.23E+00	6.15E-01	3.84E+01	2.00E+00	3.20E-02
Inorganics											
ANTIMONY	9.30E-01	0.00E+00	1.06E-02	3.47E-03	0.00E+00	1.24E-03	4.71E-03	5.90E-02	2.76E+00	7.98E-02	1.71E-03
CADMIUM	1.43E+00	0.00E+00	7.56E-01	5.34E-03	0.00E+00	8.82E-02	9.36E-02	7.70E-01	6.90E+00	1.22E-01	1.36E-02
LEAD, LABEQV	9.94E+01	0.00E+00	3.50E+00	3.71E-01	0.00E+00	4.08E-01	7.79E-01	4.70E+00	1.86E+02	1.66E-01	4.18E-03
VANADIUM	3.81E+01	0.00E+00	1.85E-01	1.42E-01	0.00E+00	2.16E-02	1.64E-01	4.16E+00	9.44E+00	3.94E-02	1.74E-02
ZINC	6.44E+01	0.00E+00	4.85E+01	2.41E-01	0.00E+00	5.67E+00	5.91E+00	7.54E+01	2.98E+02	7.83E-02	1.98E-02

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	3.290E-02	kg
Food Ingestion Rate = (If)	3.840E-03	kg/day
Water Ingestion Rate = (Iw)	7.700E-03	L/day
Soil Ingestion Rate = (Is)	1.229E-04	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Cv = Contaminant conc. in vegetation (=soil conc. * Biotransfer Factor)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (vegetation)

MEADOW VOLE - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
CENTRAL ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Avg Soil Concentration (mg/kg)	Vegetation Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Vegetation	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Semivolatile Organics									
BENZO(A)ANTHRACENE	7.69E-01	5.70E-02	8.99E-04	5.56E-03	6.46E-03	6.15E-01	3.84E+01	1.05E-02	1.68E-04
BENZO(A)PYRENE	9.89E-01	1.26E-01	1.16E-03	1.23E-02	1.34E-02	6.15E-01	3.84E+01	2.18E-02	3.50E-04
BENZO(B)FLUORANTHENE	1.50E+00	4.65E-01	1.75E-03	4.53E-02	4.71E-02	6.15E-01	3.84E+01	7.66E-02	1.23E-03
BENZO(G,H,I)PERYLENE	3.70E-01	1.22E-01	4.33E-04	1.18E-02	1.23E-02	6.15E-01	3.84E+01	2.00E-02	3.20E-04
BENZO(K)FLUORANTHENE	5.66E-01	7.09E-02	6.62E-04	6.91E-03	7.57E-03	6.15E-01	3.84E+01	1.23E-02	1.97E-04
CHRYSENE	8.99E-01	6.26E-02	1.05E-03	6.10E-03	7.15E-03	6.15E-01	3.84E+01	1.16E-02	1.86E-04
INDENO(1,2,3-CD)PYRENE	3.65E-01	4.01E-02	4.26E-04	3.91E-03	4.34E-03	6.15E-01	3.84E+01	7.05E-03	1.13E-04
PYRENE	1.66E+00	1.19E+00	1.94E-03	1.16E-01	1.18E-01	6.15E-01	3.84E+01	1.92E-01	3.08E-03
Inorganics									
ANTIMONY	5.83E-01	5.95E-03	6.82E-04	5.80E-04	1.26E-03	5.90E-02	2.76E+00	2.14E-02	4.57E-04
CADMIUM	1.07E+00	6.46E-01	1.25E-03	6.29E-02	6.42E-02	7.70E-01	6.90E+00	8.33E-02	9.30E-03
LEAD, LABEQV	2.42E+01	1.58E+00	2.83E-02	1.54E-01	1.83E-01	4.70E+00	1.86E+02	3.88E-02	9.79E-04
VANADIUM	3.03E+01	1.47E-01	3.54E-02	1.43E-02	4.97E-02	4.16E+00	9.44E+00	1.19E-02	5.27E-03
ZINC	5.28E+01	4.35E+01	6.17E-02	4.24E+00	4.30E+00	7.54E+01	2.98E+02	5.70E-02	1.44E-02

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	3.663E-02	Definitions:
Food Ingestion Rate = (If)	3.570E-03	EEQ - Ecological Effects Quotient
Water Ingestion Rate = (Iw)	6.400E-03	NOAEL - No Observed Adverse Effects Level
Soil Ingestion Rate = (Is)	4.284E-05	LOAEL - Lowest Observed Adverse Effects Level
Home Range = (HR)	1.640E-01	Cs = Contaminant concentration in soil
Contaminated Area = (CA)	Assume equal to hon	Cw = Contaminant concentration in water
H=HR/CA (Assume = to 1 for maximum exposure)		Cv = Contaminant conc. in vegetation (=soil conc. * Biotransfer Factor)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (vegetation)

BOBWHITE QUAIL - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
CENTRAL ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Max Soil Concentration (mg/kg)	Max SW Concentration (mg/L)	Vegetation Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Vegetation	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Semivolatile Organics											
BENZO(A)ANTHRACENE	6.40E+00	0.00E+00	2.01E-01	2.70E-02	0.00E+00	6.10E-03	3.31E-02	2.00E+00	2.00E+01	1.66E-02	1.66E-03
BENZO(A)PYRENE	8.10E+00	0.00E+00	9.78E-01	3.42E-02	0.00E+00	2.97E-02	6.39E-02	2.00E+00	2.00E+01	3.20E-02	3.20E-03
BENZO(B)FLUORANTHENE	1.20E+01	0.00E+00	3.72E+00	5.07E-02	0.00E+00	1.13E-01	1.64E-01	2.00E+00	2.00E+01	8.18E-02	8.18E-03
BENZO(G,H,I)PERYLENE	2.90E+00	0.00E+00	1.39E+00	1.22E-02	0.00E+00	4.22E-02	5.44E-02	2.00E+00	2.00E+01	2.72E-02	2.72E-03
BENZO(K)FLUORANTHENE	4.70E+00	0.00E+00	4.37E-01	1.98E-02	0.00E+00	1.33E-02	3.31E-02	2.00E+00	2.00E+01	1.66E-02	1.66E-03
CHRYSENE	7.40E+00	0.00E+00	2.19E-01	3.12E-02	0.00E+00	6.65E-03	3.79E-02	2.00E+00	2.00E+01	1.89E-02	1.89E-03
INDENO(1,2,3-CD)PYRENE	2.90E+00	0.00E+00	3.19E-01	1.22E-02	0.00E+00	9.69E-03	2.19E-02	2.00E+00	2.00E+01	1.10E-02	1.10E-03
PYRENE	1.40E+01	0.00E+00	1.01E+01	5.91E-02	0.00E+00	3.06E-01	3.65E-01	2.00E+00	2.00E+01	1.83E-01	1.83E-02
Inorganics											
ANTIMONY	9.30E-01	0.00E+00	1.06E-02	3.93E-03	0.00E+00	3.22E-04	4.25E-03	NV	NV	#VALUE!	#VALUE!
CADMIUM	1.43E+00	0.00E+00	7.56E-01	6.04E-03	0.00E+00	2.30E-02	2.90E-02	1.47E+00	6.35E+00	1.98E-02	4.57E-03
LEAD, LABEQV	9.94E+01	0.00E+00	3.50E+00	4.19E-01	0.00E+00	1.06E-01	5.26E-01	1.63E+00	4.46E+01	3.22E-01	1.18E-02
VANADIUM	3.81E+01	0.00E+00	1.85E-01	1.61E-01	0.00E+00	5.61E-03	1.66E-01	3.44E-01	1.70E+00	4.84E-01	9.79E-02
ZINC	6.44E+01	0.00E+00	4.85E+01	2.72E-01	0.00E+00	1.47E+00	1.75E+00	6.61E+01	1.71E+02	2.64E-02	1.02E-02

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.620E-01	kg
Food Ingestion Rate = (If)	4.920E-03	kg/day
Water Ingestion Rate = (Iw)	2.310E-02	L/day
Soil Ingestion Rate = (Is)	6.839E-04	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (vegetation)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Cv = Contaminant conc. in vegetation (=soil conc. * Biotransfer Factor)
NV = No value available
#VALUE! = Value not able to be calculated

BOBWHITE QUAIL - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
CENTRAL ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Avg Soil Concentration (mg/kg)	Vegetation Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Dose (mg/kg/day) from: Vegetation	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Semivolatile Organics									
BENZO(A)ANTHRACENE	7.69E-01	5.70E-02	1.14E-03	1.39E-03	2.54E-03	2.00E+00	2.00E+01	1.27E-03	1.27E-04
BENZO(A)PYRENE	9.89E-01	1.26E-01	1.47E-03	3.07E-03	4.55E-03	2.00E+00	2.00E+01	2.27E-03	2.27E-04
BENZO(B)FLUORANTHENE	1.50E+00	4.65E-01	2.23E-03	1.14E-02	1.36E-02	2.00E+00	2.00E+01	6.79E-03	6.79E-04
BENZO(G,H,I)PERYLENE	3.70E-01	1.22E-01	5.51E-04	2.97E-03	3.52E-03	2.00E+00	2.00E+01	1.76E-03	1.76E-04
BENZO(K)FLUORANTHENE	5.66E-01	7.09E-02	8.43E-04	1.73E-03	2.57E-03	2.00E+00	2.00E+01	1.29E-03	1.29E-04
CHRYSENE	8.99E-01	6.26E-02	1.34E-03	1.53E-03	2.87E-03	2.00E+00	2.00E+01	1.43E-03	1.43E-04
INDENO(1,2,3-CD)PYRENE	3.65E-01	4.01E-02	5.43E-04	9.79E-04	1.52E-03	2.00E+00	2.00E+01	7.61E-04	7.61E-05
PYRENE	1.66E+00	1.19E+00	2.47E-03	2.91E-02	3.16E-02	2.00E+00	2.00E+01	1.58E-02	1.58E-03
Inorganics									
ANTIMONY	5.83E-01	5.95E-03	8.68E-04	1.45E-04	1.01E-03	NV	NV	#VALUE!	#VALUE!
CADMIUM	1.07E+00	6.46E-01	1.59E-03	1.58E-02	1.73E-02	1.47E+00	6.35E+00	1.18E-02	2.73E-03
LEAD, LABEQV	2.42E+01	1.58E+00	3.60E-02	3.86E-02	7.46E-02	1.63E+00	4.46E+01	4.58E-02	1.67E-03
VANADIUM	3.03E+01	1.47E-01	4.51E-02	3.58E-03	4.86E-02	3.44E-01	1.70E+00	1.41E-01	2.86E-02
ZINC	5.28E+01	4.35E+01	7.86E-02	1.06E+00	1.14E+00	6.61E+01	1.71E+02	1.72E-02	6.66E-03

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.770E-01	<u>Definitions:</u>
Food Ingestion Rate = (If)	4.320E-03	EEQ - Ecological Effects Quotient
Water Ingestion Rate = (Iw)	1.840E-02	NOAEL - No Observed Adverse Effects Level
Soil Ingestion Rate = (Is)	2.635E-04	LOAEL - Lowest Observed Adverse Effects Level
Home Range = (HR)	2.860E+01	Cs = Contaminant concentration in soil
Contaminated Area = (CA)	Assume equal to h	Cw = Contaminant concentration in water
H=HR/CA (Assume = to 1 for maximum exposure)		Cv = Contaminant conc. in vegetation (=soil conc. * Biotransfer Factor)
		NV = No value available
Dose (surface soil) = (Cs * Is)(H)/BW		#VALUE! = Value not able to be calculated

Dose (surface water) = (Cw * Iw)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (vegetation)

SHORT-TAILED SHREW - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
CENTRAL ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Max Soil Concentration (mg/kg)	Max SW Concentration (mg/L)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Inverts.	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Semivolatile Organics										
BENZO(A)ANTHRACENE	6.40E+00	0.00E+00	1.03E+01	3.26E-02	1.75E+00	1.78E+00	6.15E-01	3.84E+01	2.89E+00	4.64E-02
BENZO(A)PYRENE	8.10E+00	0.00E+00	1.30E+01	4.13E-02	2.21E+00	2.25E+00	6.15E-01	3.84E+01	3.66E+00	5.87E-02
BENZO(B)FLUORANTHENE	1.20E+01	0.00E+00	1.93E+01	6.12E-02	3.28E+00	3.34E+00	6.15E-01	3.84E+01	5.43E+00	8.69E-02
BENZO(G,H,I)PERYLENE	2.90E+00	0.00E+00	4.66E+00	1.48E-02	7.92E-01	8.07E-01	6.15E-01	3.84E+01	1.31E+00	2.10E-02
BENZO(K)FLUORANTHENE	4.70E+00	0.00E+00	7.55E+00	2.40E-02	1.28E+00	1.31E+00	6.15E-01	3.84E+01	2.13E+00	3.40E-02
CHRYSENE	7.40E+00	0.00E+00	1.19E+01	3.77E-02	2.02E+00	2.06E+00	6.15E-01	3.84E+01	3.35E+00	5.36E-02
INDENO(1,2,3-CD)PYRENE	2.90E+00	0.00E+00	4.66E+00	1.48E-02	7.92E-01	8.07E-01	6.15E-01	3.84E+01	1.31E+00	2.10E-02
PYRENE	1.40E+01	0.00E+00	2.25E+01	7.14E-02	3.82E+00	3.89E+00	6.15E-01	3.84E+01	6.33E+00	1.01E-01
Inorganics										
ANTIMONY	9.30E-01	0.00E+00	9.30E-01	4.74E-03	1.58E-01	1.63E-01	5.90E-02	2.76E+00	2.76E+00	5.90E-02
CADMIUM	1.43E+00	0.00E+00	1.10E+01	7.29E-03	1.87E+00	1.88E+00	7.70E-01	6.90E+00	2.44E+00	2.72E-01
LEAD, LABEQV	9.94E+01	0.00E+00	3.29E+01	5.07E-01	5.59E+00	6.10E+00	4.70E+00	1.86E+02	1.30E+00	3.27E-02
VANADIUM	3.81E+01	0.00E+00	1.60E+00	1.94E-01	2.72E-01	4.66E-01	4.16E+00	9.44E+00	1.12E-01	4.94E-02
ZINC	6.44E+01	0.00E+00	3.35E+02	3.28E-01	5.70E+01	5.73E+01	7.54E+01	2.98E+02	7.60E-01	1.92E-01

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.525E-02	kg
Food Ingestion Rate = (If)	2.592E-03	kg/day
Water Ingestion Rate = (Iw)	4.300E-03	L/day
Soil Ingestion Rate = (Is)	7.776E-05	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (invertebrates) = (Ci * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (invertebrates)

SHORT-TAILED SHREW - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
CENTRAL ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Avg Soil Concentration (mg/kg)	Avg SW Concentration (mg/L)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Inverts.	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Semivolatile Organics											
BENZO(A)ANTHRACENE	7.69E-01	0.00E+00	4.68E-01	6.76E-04	0.00E+00	4.57E-02	4.64E-02	6.15E-01	3.84E+01	7.55E-02	1.21E-03
BENZO(A)PYRENE	9.89E-01	0.00E+00	6.02E-01	8.70E-04	0.00E+00	5.88E-02	5.97E-02	6.15E-01	3.84E+01	9.71E-02	1.55E-03
BENZO(B)FLUORANTHENE	1.50E+00	0.00E+00	9.13E-01	1.32E-03	0.00E+00	8.92E-02	9.05E-02	6.15E-01	3.84E+01	1.47E-01	2.36E-03
BENZO(G,H,I)PERYLENE	3.70E-01	0.00E+00	2.25E-01	3.25E-04	0.00E+00	2.20E-02	2.23E-02	6.15E-01	3.84E+01	3.63E-02	5.81E-04
BENZO(K)FLUORANTHENE	5.66E-01	0.00E+00	3.45E-01	4.98E-04	0.00E+00	3.37E-02	3.42E-02	6.15E-01	3.84E+01	5.55E-02	8.90E-04
CHRYSENE	8.99E-01	0.00E+00	5.48E-01	7.91E-04	0.00E+00	5.35E-02	5.43E-02	6.15E-01	3.84E+01	8.83E-02	1.41E-03
INDENO(1,2,3-CD)PYRENE	3.65E-01	0.00E+00	2.22E-01	3.21E-04	0.00E+00	2.17E-02	2.20E-02	6.15E-01	3.84E+01	3.58E-02	5.73E-04
PYRENE	1.66E+00	0.00E+00	1.01E+00	1.46E-03	0.00E+00	9.85E-02	1.00E-01	6.15E-01	3.84E+01	1.63E-01	2.60E-03
Inorganics											
ANTIMONY	5.83E-01	0.00E+00	5.83E-01	5.13E-04	0.00E+00	5.70E-02	5.75E-02	5.90E-02	2.76E+00	9.75E-01	2.08E-02
CADMIUM	1.07E+00	0.00E+00	8.74E+00	9.41E-04	0.00E+00	8.54E-01	8.55E-01	7.70E-01	6.90E+00	1.11E+00	1.24E-01
LEAD, LABEQV	2.42E+01	0.00E+00	1.05E+01	2.13E-02	0.00E+00	1.03E+00	1.05E+00	4.70E+00	1.86E+02	2.23E-01	5.62E-03
VANADIUM	3.03E+01	0.00E+00	1.27E+00	2.66E-02	0.00E+00	1.24E-01	1.51E-01	4.16E+00	9.44E+00	3.62E-02	1.60E-02
ZINC	5.28E+01	0.00E+00	3.14E+02	4.64E-02	0.00E+00	3.07E+01	3.07E+01	7.54E+01	2.98E+02	4.08E-01	1.03E-01

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.687E-02	kg
Food Ingestion Rate = (If)	1.648E-03	kg/day
Water Ingestion Rate = (Iw)	3.800E-03	L/day
Soil Ingestion Rate = (Is)	1.483E-05	kg/day
Home Range = (HR)	9.700E-01	acres
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (invertebrates) = (Ci * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (invertebrates)

AMERICAN WOODCOCK - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
CENTRAL ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Max Soil Concentration (mg/kg)	Max SW Concentration (mg/L)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Inverts.	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Semivolatile Organics											
BENZO(A)ANTHRACENE	6.40E+00	0.00E+00	1.03E+01	1.92E-01	0.00E+00	1.88E+00	2.07E+00	2.00E+00	2.00E+01	1.03E+00	1.03E-01
BENZO(A)PYRENE	8.10E+00	0.00E+00	1.30E+01	2.43E-01	0.00E+00	2.38E+00	2.62E+00	2.00E+00	2.00E+01	1.31E+00	1.31E-01
BENZO(B)FLUORANTHENE	1.20E+01	0.00E+00	1.93E+01	3.59E-01	0.00E+00	3.52E+00	3.88E+00	2.00E+00	2.00E+01	1.94E+00	1.94E-01
BENZO(G,H,I)PERYLENE	2.90E+00	0.00E+00	4.66E+00	8.69E-02	0.00E+00	8.51E-01	9.38E-01	2.00E+00	2.00E+01	4.69E-01	4.69E-02
BENZO(K)FLUORANTHENE	4.70E+00	0.00E+00	7.55E+00	1.41E-01	0.00E+00	1.38E+00	1.52E+00	2.00E+00	2.00E+01	7.60E-01	7.60E-02
CHRYSENE	7.40E+00	0.00E+00	1.19E+01	2.22E-01	0.00E+00	2.17E+00	2.39E+00	2.00E+00	2.00E+01	1.20E+00	1.20E-01
INDENO(1,2,3-CD)PYRENE	2.90E+00	0.00E+00	4.66E+00	8.69E-02	0.00E+00	8.51E-01	9.38E-01	2.00E+00	2.00E+01	4.69E-01	4.69E-02
PYRENE	1.40E+01	0.00E+00	2.25E+01	4.19E-01	0.00E+00	4.11E+00	4.53E+00	2.00E+00	2.00E+01	2.26E+00	2.26E-01
Inorganics											
ANTIMONY	9.30E-01	0.00E+00	9.30E-01	2.79E-02	0.00E+00	1.70E-01	1.98E-01	NV	NV	#VALUE!	#VALUE!
CADMIUM	1.43E+00	0.00E+00	1.10E+01	4.28E-02	0.00E+00	2.01E+00	2.05E+00	1.47E+00	6.35E+00	1.40E+00	3.23E-01
LEAD, LABEQV	9.94E+01	0.00E+00	3.29E+01	2.98E+00	0.00E+00	6.01E+00	8.98E+00	1.63E+00	4.46E+01	5.51E+00	2.01E-01
VANADIUM	3.81E+01	0.00E+00	1.60E+00	1.14E+00	0.00E+00	2.92E-01	1.43E+00	3.44E-01	1.70E+00	4.17E+00	8.43E-01
ZINC	6.44E+01	0.00E+00	3.35E+02	1.93E+00	0.00E+00	6.13E+01	6.32E+01	6.61E+01	1.71E+02	9.56E-01	3.69E-01

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW) 1.660E-01 kg
Food Ingestion Rate = (If) 3.032E-02 kg/day
Water Ingestion Rate = (Iw) 1.900E-02 L/day
Soil Ingestion Rate = (Is) 4.972E-03 kg/day
Home Range = (HR) Assume 100% on site
Contaminated Area = (CA) Assume equal to home range
H=HR/CA (Assume = to 1 for maximum exposure)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (invertebrates) = (Ci * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (invertebrates)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)
NV = No value available
#VALUE! = Value not able to be calculated

AMERICAN WOODCOCK - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
CENTRAL ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Avg Soil Concentration (mg/kg)	Avg SW Concentration (mg/L)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Inverts.	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Semivolatile Organics											
BENZO(A)ANTHRACENE	7.69E-01	0.00E+00	4.68E-01	6.56E-03	0.00E+00	6.24E-02	6.90E-02	2.00E+00	2.00E+01	3.45E-02	3.45E-03
BENZO(A)PYRENE	9.89E-01	0.00E+00	6.02E-01	8.44E-03	0.00E+00	8.03E-02	8.87E-02	2.00E+00	2.00E+01	4.44E-02	4.44E-03
BENZO(B)FLUORANTHENE	1.50E+00	0.00E+00	9.13E-01	1.28E-02	0.00E+00	1.22E-01	1.35E-01	2.00E+00	2.00E+01	6.73E-02	6.73E-03
BENZO(G,H,I)PERYLENE	3.70E-01	0.00E+00	2.25E-01	3.16E-03	0.00E+00	3.00E-02	3.32E-02	2.00E+00	2.00E+01	1.66E-02	1.66E-03
BENZO(K)FLUORANTHENE	5.66E-01	0.00E+00	3.45E-01	4.83E-03	0.00E+00	4.59E-02	5.08E-02	2.00E+00	2.00E+01	2.54E-02	2.54E-03
CHRYSENE	8.99E-01	0.00E+00	5.48E-01	7.67E-03	0.00E+00	7.30E-02	8.07E-02	2.00E+00	2.00E+01	4.03E-02	4.03E-03
INDENO(1,2,3-CD)PYRENE	3.65E-01	0.00E+00	2.22E-01	3.11E-03	0.00E+00	2.96E-02	3.27E-02	2.00E+00	2.00E+01	1.64E-02	1.64E-03
PYRENE	1.66E+00	0.00E+00	1.01E+00	1.41E-02	0.00E+00	1.34E-01	1.49E-01	2.00E+00	2.00E+01	7.43E-02	7.43E-03
Inorganics											
ANTIMONY	5.83E-01	0.00E+00	5.83E-01	4.98E-03	0.00E+00	7.78E-02	8.27E-02	NV	NV	#VALUE!	#VALUE!
CADMIUM	1.07E+00	0.00E+00	8.74E+00	9.14E-03	0.00E+00	1.17E+00	1.17E+00	1.47E+00	6.35E+00	8.01E-01	1.85E-01
LEAD, LABEQV	2.42E+01	0.00E+00	1.05E+01	2.06E-01	0.00E+00	1.40E+00	1.61E+00	1.63E+00	4.46E+01	9.86E-01	3.60E-02
VANADIUM	3.03E+01	0.00E+00	1.27E+00	2.58E-01	0.00E+00	1.69E-01	4.28E-01	3.44E-01	1.70E+00	1.24E+00	2.52E-01
ZINC	5.28E+01	0.00E+00	3.14E+02	4.50E-01	0.00E+00	4.19E+01	4.23E+01	6.61E+01	1.71E+02	6.40E-01	2.48E-01

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.895E-01	kg
Food Ingestion Rate = (If)	2.526E-02	kg/day
Water Ingestion Rate = (Iw)	1.900E-02	L/day
Soil Ingestion Rate = (Is)	1.617E-03	kg/day
Home Range = (HR)	6.133E+01	acres
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (invertebrates) = (Ci * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (invertebrates)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)
NV = No value available
#VALUE! = Value not able to be calculated

APPENDIX F

CHEMICAL CONCENTRATIONS IN SURFACE SOIL AND TISSUE
SOUTHERN ZONE - UXO 7
NSWC CRANE
CRANE, INDIANA

Chemical	Surface Soil Concentrations (mg/kg)				Earthworm Bioaccumulation Factors		Earthworm Concentrations (mg/kg)		Plant Bioaccumulation Factors		Plant Concentrations (mg/kg)	
	Maximum Detection	Average All	Average of Positive Detections	Average (1)	Conservative	Average	Maximum Detection	Average	Conservative	Average	Maximum Detection	Average
Inorganics												
ANTIMONY	1.11E+01	3.82E+00	4.32E+00	3.82E+00	1.00E+00	1.00E+00	1.11E+01	3.82E+00	1.14E-02	1.02E-02	1.27E-01	3.90E-02
CADMIUM	1.79E+00	1.09E+00	1.09E+00	1.09E+00	Regression or BAF from Eco SSL		1.32E+01	8.87E+00	Regression or BAF from Eco SSL		8.55E-01	6.52E-01
CHROMIUM	6.66E+01	2.87E+01	2.87E+01	2.87E+01	Regression or BAF from Eco SSL		2.04E+01	8.79E+00	Regression or BAF from Eco SSL		2.73E+00	1.18E+00
COPPER	4.27E+02	8.30E+01	8.30E+01	8.30E+01	Regression or BAF from Eco SSL		2.20E+02	4.27E+01	Regression or BAF from Eco SSL		2.12E+01	1.11E+01
LEAD, LABEQV	5.37E+02	7.26E+01	7.80E+01	7.26E+01	Regression or BAF from Eco SSL		1.28E+02	2.55E+01	Regression or BAF from Eco SSL		9.01E+00	2.93E+00
NICKEL	5.02E+01	2.69E+01	2.69E+01	2.69E+01	4.73E+00	1.06E+00	2.37E+02	2.85E+01	Regression or BAF from Eco SSL		2.03E+00	1.27E+00
SELENIUM	8.10E-01	6.29E-01	6.29E-01	6.29E-01	Regression or BAF from Eco SSL		7.95E-01	6.60E-01	Regression or BAF from Eco SSL		4.03E-01	3.04E-01
VANADIUM	4.63E+01	3.23E+01	3.23E+01	3.23E+01	Regression or BAF from Eco SSL		1.94E+00	1.36E+00	Regression or BAF from Eco SSL		2.25E-01	1.57E-01
ZINC	1.48E+02	8.93E+01	8.93E+01	8.93E+01	Regression or BAF from Eco SSL		4.41E+02	3.73E+02	Regression or BAF from Eco SSL		7.70E+01	5.82E+01

1 - If the average of all value is the greater than the maximum detection, the average of the positive detections was *used as the average value.*

MEADOW VOLE - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SOUTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Max Soil Concentration (mg/kg)	Max SW Concentration (mg/L)	Vegetation Concentration (mg/kg)	Dose (mg/kg/day) from:			Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
				Surface Soil	Surface Water	Vegetation					
Inorganics											
ANTIMONY	1.11E+01	0.00E+00	1.27E-01	4.15E-02	0.00E+00	1.48E-02	5.62E-02	9.59E-02	9.59E-01	5.86E-01	5.86E-02
CADMIUM	1.79E+00	0.00E+00	8.55E-01	6.69E-03	0.00E+00	9.97E-02	1.06E-01	7.70E-01	6.90E+00	1.38E-01	1.54E-02
CHROMIUM	6.66E+01	0.00E+00	2.73E+00	2.49E-01	0.00E+00	3.19E-01	5.67E-01	2.40E+00	5.82E+01	2.36E-01	9.75E-03
COPPER	4.27E+02	0.00E+00	2.12E+01	1.59E+00	0.00E+00	2.48E+00	4.07E+00	5.60E+00	8.27E+01	7.27E-01	4.92E-02
LEAD	5.37E+02	0.00E+00	9.01E+00	2.01E+00	0.00E+00	1.05E+00	3.06E+00	4.70E+00	1.86E+02	6.51E-01	1.64E-02
NICKEL	5.02E+01	0.00E+00	2.03E+00	1.87E-01	0.00E+00	2.36E-01	4.24E-01	1.70E+00	1.48E+01	2.49E-01	2.87E-02
SELENIUM	8.10E-01	0.00E+00	4.03E-01	3.03E-03	0.00E+00	4.70E-02	5.00E-02	1.43E-01	6.60E-01	3.50E-01	7.58E-02
VANADIUM	4.63E+01	0.00E+00	2.25E-01	1.73E-01	0.00E+00	2.62E-02	1.99E-01	4.16E+00	9.44E+00	4.79E-02	2.11E-02
ZINC	1.48E+02	0.00E+00	7.70E+01	5.53E-01	0.00E+00	8.98E+00	9.54E+00	7.54E+01	2.98E+02	1.26E-01	3.20E-02

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	3.290E-02	kg
Food Ingestion Rate = (If)	3.840E-03	kg/day
Water Ingestion Rate = (Iw)	7.700E-03	L/day
Soil Ingestion Rate = (Is)	1.229E-04	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Cv = Contaminant conc. in vegetation (=soil conc. * Biotransfer Factor)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (vegetation)

MEADOW VOLE - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SOUTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Avg Soil Concentration (mg/kg)	Avg SW Concentration (mg/L)	Vegetation Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Vegetation	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics											
ANTIMONY	3.82E+00	0.00E+00	3.90E-02	4.47E-03	0.00E+00	3.80E-03	8.27E-03	5.90E-02	2.76E+00	1.40E-01	3.00E-03
CADMIUM	1.09E+00	0.00E+00	6.52E-01	1.28E-03	0.00E+00	6.36E-02	6.48E-02	7.70E-01	6.90E+00	8.42E-02	9.39E-03
CHROMIUM	2.87E+01	0.00E+00	1.18E+00	3.36E-02	0.00E+00	1.15E-01	1.48E-01	2.40E+00	5.82E+01	6.18E-02	2.55E-03
COPPER	8.30E+01	0.00E+00	1.11E+01	9.70E-02	0.00E+00	1.08E+00	1.18E+00	5.60E+00	8.27E+01	2.11E-01	1.43E-02
LEAD	7.26E+01	0.00E+00	2.93E+00	8.49E-02	0.00E+00	2.86E-01	3.71E-01	4.70E+00	1.86E+02	7.88E-02	1.99E-03
NICKEL	2.69E+01	0.00E+00	1.27E+00	3.15E-02	0.00E+00	1.24E-01	1.55E-01	1.70E+00	1.48E+01	9.14E-02	1.05E-02
SELENIUM	6.29E-01	0.00E+00	3.04E-01	7.35E-04	0.00E+00	2.97E-02	3.04E-02	1.43E-01	6.60E-01	2.13E-01	4.61E-02
VANADIUM	3.23E+01	0.00E+00	1.57E-01	3.78E-02	0.00E+00	1.53E-02	5.30E-02	4.16E+00	9.44E+00	1.27E-02	5.62E-03
ZINC	8.93E+01	0.00E+00	5.82E+01	1.04E-01	0.00E+00	5.67E+00	5.77E+00	7.54E+01	2.98E+02	7.66E-02	1.94E-02

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	3.663E-02	kg
Food Ingestion Rate = (If)	3.570E-03	kg/day
Water Ingestion Rate = (Iw)	6.400E-03	L/day
Soil Ingestion Rate = (Is)	4.284E-05	kg/day
Home Range = (HR)	1.640E-01	acres
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Cv = Contaminant conc. in vegetation (=soil conc. * Biotransfer Factor)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (vegetation)

BOBWHITE QUAIL - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SOUTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Max Soil Concentration (mg/kg)	Max SW Concentration (mg/L)	Vegetation Concentration (mg/kg)	Dose (mg/kg/day) from:			Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
				Surface Soil	Surface Water	Vegetation					
Inorganics											
ANTIMONY	1.11E+01	0.00E+00	1.27E-01	4.69E-02	0.00E+00	3.84E-03	5.07E-02	NV	NV	#VALUE!	#VALUE!
CADMIUM	1.79E+00	0.00E+00	8.55E-01	7.56E-03	0.00E+00	2.60E-02	3.35E-02	1.47E+00	6.35E+00	2.28E-02	5.28E-03
CHROMIUM	6.66E+01	0.00E+00	2.73E+00	2.81E-01	0.00E+00	8.29E-02	3.64E-01	2.66E+00	1.56E+01	1.37E-01	2.33E-02
COPPER	4.27E+02	0.00E+00	2.12E+01	1.80E+00	0.00E+00	6.44E-01	2.45E+00	4.05E+00	3.49E+01	6.04E-01	7.02E-02
LEAD	5.37E+02	0.00E+00	9.01E+00	2.27E+00	0.00E+00	2.74E-01	2.54E+00	1.63E+00	4.46E+01	1.56E+00	5.69E-02
NICKEL	5.02E+01	0.00E+00	2.03E+00	2.12E-01	0.00E+00	6.15E-02	2.73E-01	6.71E+00	1.86E+01	4.08E-02	1.47E-02
SELENIUM	8.10E-01	0.00E+00	4.03E-01	3.42E-03	0.00E+00	1.22E-02	1.56E-02	2.90E-01	8.20E-01	5.40E-02	1.91E-02
VANADIUM	4.63E+01	0.00E+00	2.25E-01	1.95E-01	0.00E+00	6.82E-03	2.02E-01	3.44E-01	1.70E+00	5.88E-01	1.19E-01
ZINC	1.48E+02	0.00E+00	7.70E+01	6.25E-01	0.00E+00	2.34E+00	2.96E+00	6.61E+01	1.71E+02	4.48E-02	1.73E-02

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.620E-01	kg
Food Ingestion Rate = (If)	4.920E-03	kg/day
Water Ingestion Rate = (Iw)	2.310E-02	L/day
Soil Ingestion Rate = (Is)	6.839E-04	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (vegetation)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Cv = Contaminant conc. in vegetation (=soil conc. * Biotransfer Factor)
NV = No value available
#VALUE! = Value not able to be calculated

BOBWHITE QUAIL - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SOUTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Avg Soil Concentration (mg/kg)	Avg SW Concentration (mg/L)	Vegetation Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Vegetation	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics											
ANTIMONY	3.82E+00	0.00E+00	3.90E-02	5.69E-03	0.00E+00	9.52E-04	6.64E-03	NV	NV	#VALUE!	#VALUE!
CADMIUM	1.09E+00	0.00E+00	6.52E-01	1.62E-03	0.00E+00	1.59E-02	1.75E-02	1.47E+00	6.35E+00	1.20E-02	2.76E-03
CHROMIUM	2.87E+01	0.00E+00	1.18E+00	4.28E-02	0.00E+00	2.87E-02	7.15E-02	2.66E+00	1.56E+01	2.69E-02	4.58E-03
COPPER	8.30E+01	0.00E+00	1.11E+01	1.24E-01	0.00E+00	2.71E-01	3.95E-01	4.05E+00	3.49E+01	9.75E-02	1.13E-02
LEAD	7.26E+01	0.00E+00	2.93E+00	1.08E-01	0.00E+00	7.15E-02	1.80E-01	1.63E+00	4.46E+01	1.10E-01	4.02E-03
NICKEL	2.69E+01	0.00E+00	1.27E+00	4.00E-02	0.00E+00	3.10E-02	7.11E-02	6.71E+00	1.86E+01	1.06E-02	3.83E-03
SELENIUM	6.29E-01	0.00E+00	3.04E-01	9.36E-04	0.00E+00	7.43E-03	8.36E-03	2.90E-01	8.20E-01	2.88E-02	1.02E-02
VANADIUM	3.23E+01	0.00E+00	1.57E-01	4.81E-02	0.00E+00	3.82E-03	5.19E-02	3.44E-01	1.70E+00	1.51E-01	3.05E-02
ZINC	8.93E+01	0.00E+00	5.82E+01	1.33E-01	0.00E+00	1.42E+00	1.55E+00	6.61E+01	1.71E+02	2.35E-02	9.08E-03

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.770E-01	kg
Food Ingestion Rate = (If)	4.320E-03	kg/day
Water Ingestion Rate = (Iw)	1.840E-02	L/day
Soil Ingestion Rate = (Is)	2.635E-04	kg/day
Home Range = (HR)	2.860E+01	acres
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (vegetation)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Cv = Contaminant conc. in vegetation (=soil conc. * Biotransfer Factor)
NV = No value available
#VALUE! = Value not able to be calculated

APPENDIX F

BACKGROUND STATISTICAL COMPARISONS
NORTHERN ZONE – UXO 7
NSWC CRANE
CRANE, INDIANA

The remaining background comparisons were completed by dividing the site into three locations (Southern, Northern, and Central). The background comparisons were done by examining descriptive statistics, boxplots, means plots, and if need a formal statistical test of differences.

Table 47 contains the descriptive statistics for cobalt north and background. From this table it can be seen that the mean, median, minimum, and lower and upper quartile north concentrations are slightly greater than the background concentrations.

Variable	Descriptive Statistics UXO North							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Cobalt North	18	15.10667	14.35000	9.720000	22.80000	12.50000	17.60000	3.523648
Cobalt Background	8	13.72500	13.60000	8.400000	27.10000	8.75000	14.80000	6.087868

Table 47

Figure 106 contains the side by side box plots for Cobalt. From this table it can be seen that the median site concentrations are extremely similar; the lower quartile and upper quartile north concentrations are greater than the background the background concentrations.

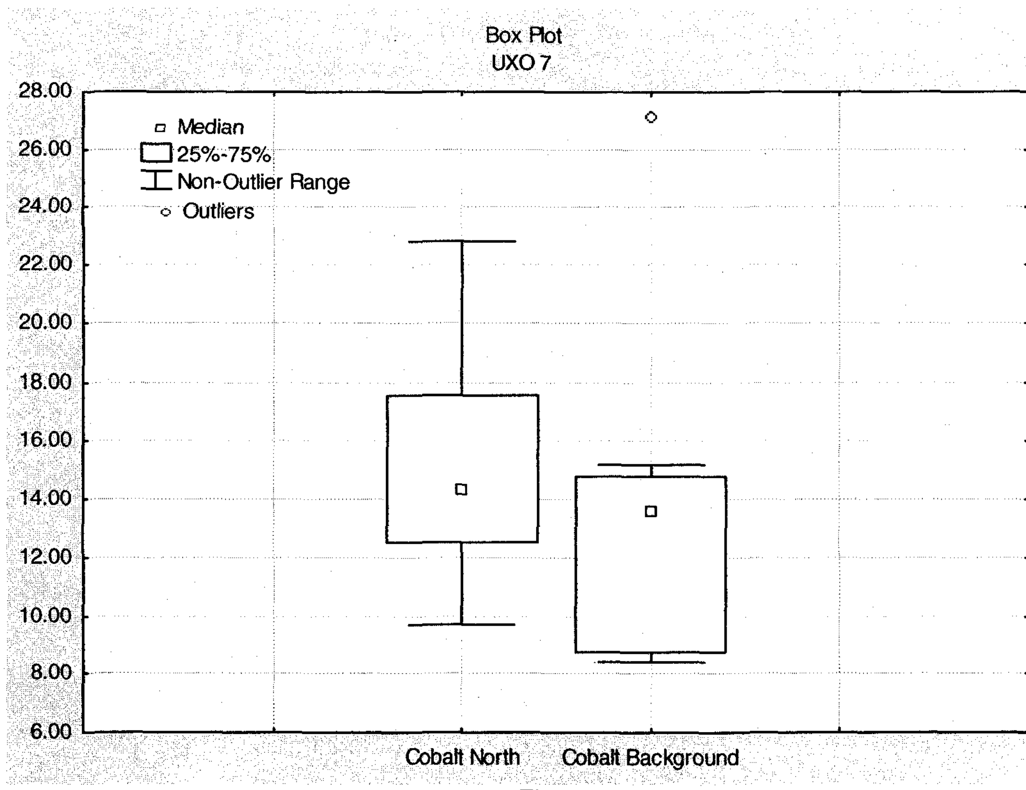


Figure 106

Figure 107 contains the side by side mean plot for the cobalt north and background concentrations. From figure 107 it can be seen that the north cobalt mean is greater than the background mean. It can also be seen that the confidence interval for the north cobalt concentrations is smaller than the background confidence interval.

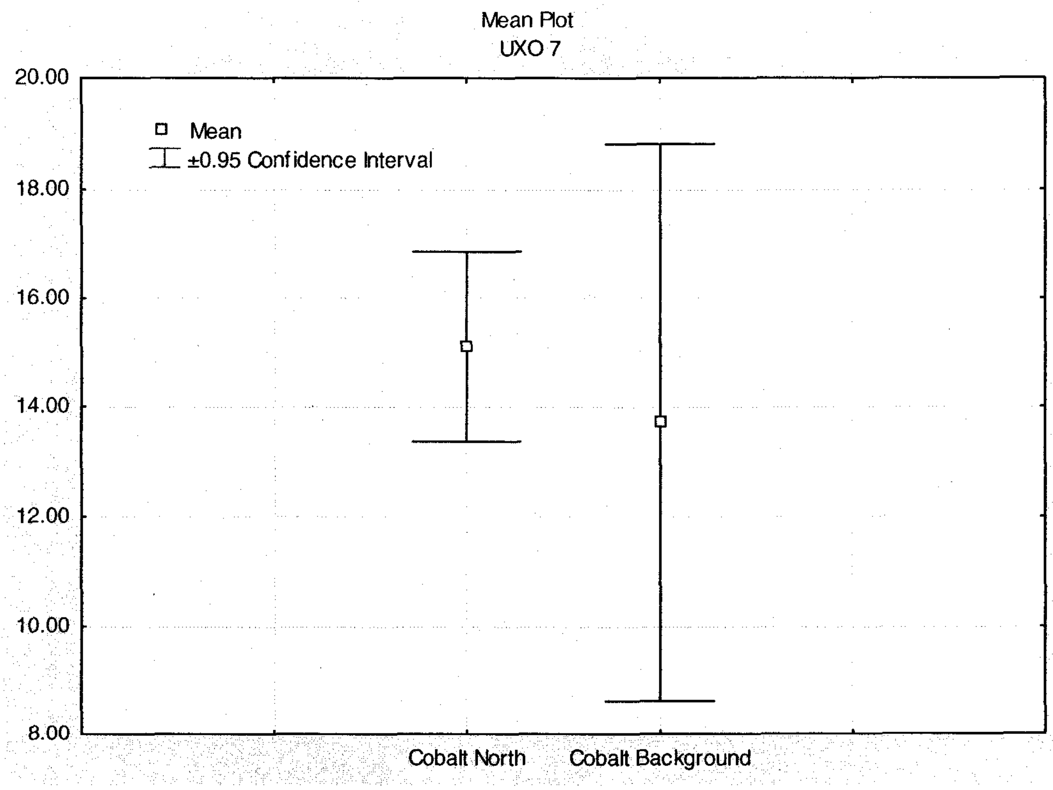


Figure 107

Figure 108 contains the normal probability plot for the north cobalt concentrations. From this plot it can be seen that the data follow the line and that the corresponding pvalue for the Shapiro Wilk test is 0.42. Therefore the north concentrations are not normally distributed. From Figure 37 it was concluded that the cobalt background concentrations are not normally distributed.

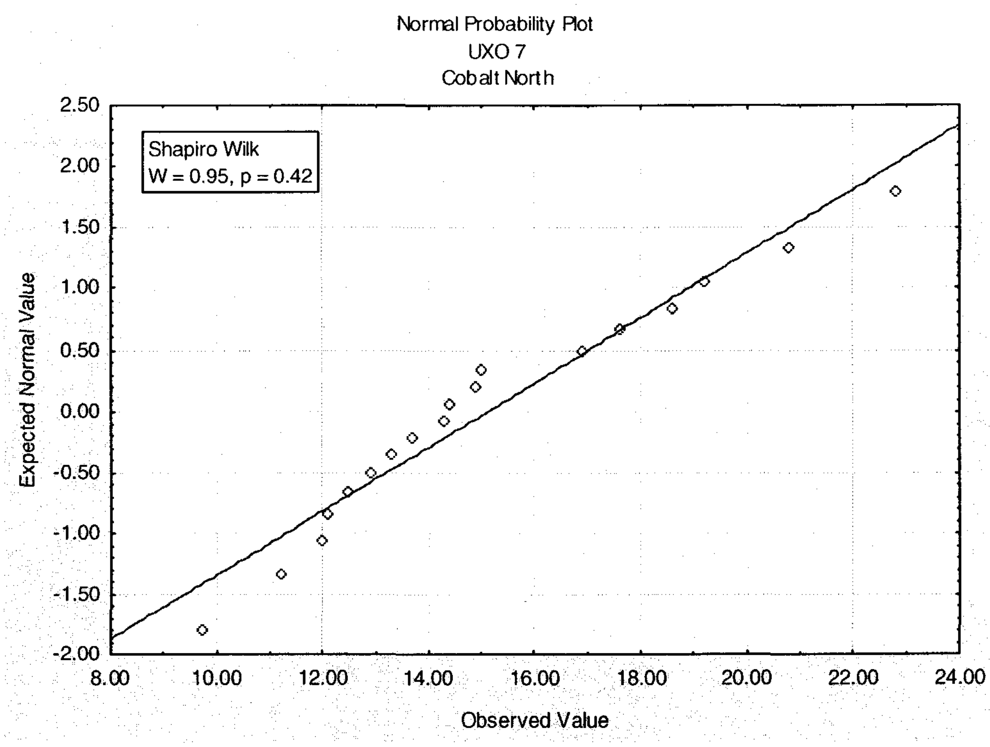


Figure 108

Table 48 contains the Test Statistic and corresponding p value for Levene's test for equality of variance. The Levene Test tests the hypothesis that the variances of the Site and Background Concentrations are equal. If the p-value for Levene's test is less than 0.05 than the variances of the distributions are not equal. From Table 48 it can be seen that the p-value for Levene's Test is 0.40 so the variances of the North and Background Cobalt Concentrations are equal.

Levene's Test	
Levene F(1,df)	.74
Degrees of freedom (df)	24
p-value	0.40

Table 48

Because the site and background concentrations are not normally distributed and the variances are equal, the Wilcoxon Rank Sum Test was used to determine if there are differences between the two data sets. The Wilcoxon Rank Sum Test tests the hypothesis that the north cobalt concentrations are equal to the background cobalt concentrations. Table 49 contains the Test Statistic and corresponding p value for the Wilcoxon Rank Sum Test, because the pvalue is greater than 0.05 we fail to reject the null that there is no difference between the background and site concentrations.

Wilcoxon Rank Sum Test	
Test Statistic	90
P Value	>.10

Table 49

Table 50 contains the descriptive statistics for manganese. From this table it can be seen that the mean, median, minimum, maximum, and lower and upper quartile north concentrations are less than the background concentrations.

Variable	Descriptive Statistics UXO 7 North							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Manganese North	18	748.333	687.000	334.0000	1310.000	544.0000	919.000	265.2422
Manganese Background	8	1417.250	1405.000	666.0000	3040.000	786.0000	1625.000	765.2654

Table 50

Figure 109 contains the side by side box plots for manganese. From this plot it can be seen that the lower quartile of the site copper concentrations is higher than the lower quartile for the background concentrations. It can also be seen that the south median and upper quartile concentrations are less than the background median concentrations.

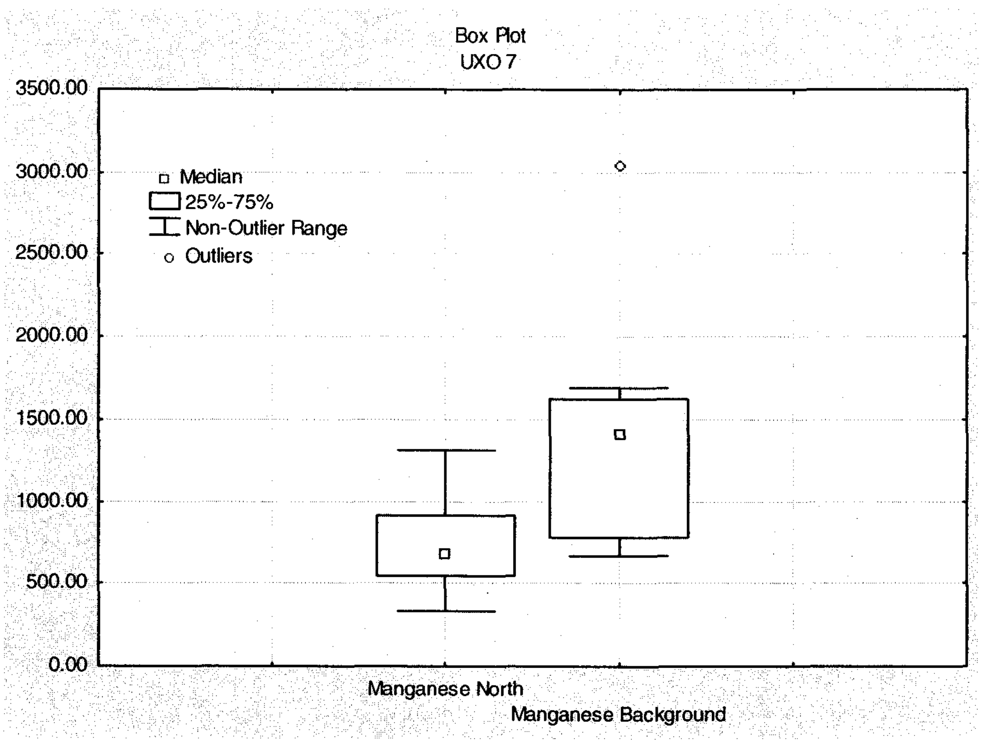


Figure 109

Figure 110 shows the side by side means plots. From this figure it can be seen that the site mean concentration is lower than the mean background concentration. The Upper Confidence limit of the north manganese concentrations is less than the mean background concentration and slightly greater than the lower confidence limit of the background manganese concentrations.

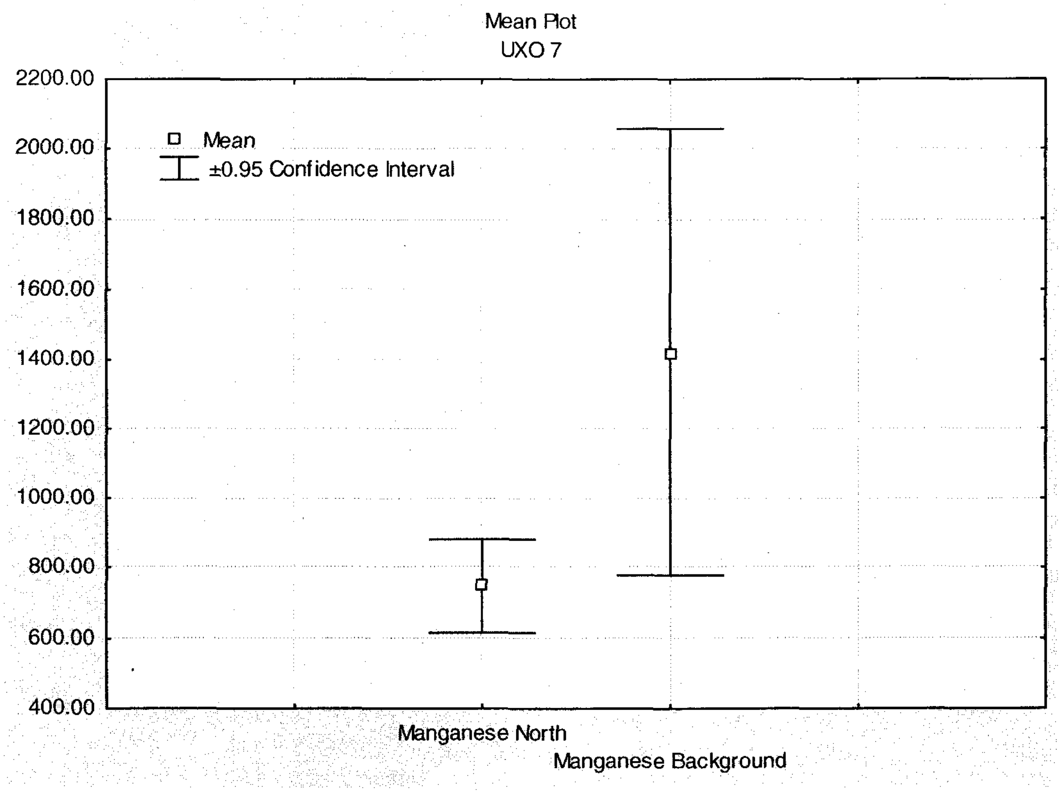


Figure 110

From examining the background statistics, the boxplots, and the means concentrations it can be seen that the north manganese concentrations are less than the background manganese concentrations.

Table 51 contains the descriptive statistics for the North Selenium concentrations. The background selenium concentrations are all non-detect with detection limits ranging from 1.3-0.64. From the descriptive statistics it can be seen that the maximum concentration from the North selenium concentrations is less than the highest background detection limit. It should also be noticed that the mean, median, and upper quartile north concentrations are less than the lowest background detection limit. Therefore, the north selenium concentrations do not appear greater than the background concentrations.

Variable	Descriptive Statistics UXO 7							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Selenium North	18	0.460000	0.378000	0.249000	0.913000	0.365000	0.604000	0.182733

Table 51

APPENDIX F

BACKGROUND STATISTICAL COMPARISONS
CENTRAL ZONE – UXO 7
NSWC CRANE
CRANE, INDIANA

The remaining background comparisons were completed by dividing the site into three locations (Southern, Northern, and Central). The background comparisons were done by examining descriptive statistics, boxplots, means plots, and if need a formal statistical test of differences.

Table 52 contains the summary statistics for the cobalt central and background concentrations. From this table it can be seen that the mean, median, minimum, maximum, lower quartile and upper quartile central concentrations are less than the corresponding background concentrations. With a sample size of 3 for the central cobalt concentrations, only a simple comparison of descriptive statistics is an applicable. From these descriptive statistics it appears that the central cobalt concentrations are not greater than the background concentrations.

Variable	Descriptive Statistics UXO 7 Central Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Cobalt Central	3	10.49667	10.30000	6.790000	14.40000	6.790000	14.40000	3.808810
Cobalt Background	8	13.72500	13.60000	8.400000	27.10000	8.750000	14.80000	6.087868

Table 52

Table 53 contains the summary statistics for the manganese central and background concentrations. From this table it can be seen that the mean, median, minimum, maximum, lower quartile and upper quartile central concentrations are greater than the corresponding background concentrations. With a sample size of 3 for the central manganese concentrations, only a simple comparison of descriptive statistics is an applicable. From these descriptive statistics it appears that the central manganese concentrations are greater than the background concentrations.

Variable	Descriptive Statistics UXO 7 Central Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Manganese Central	3	598.0000	677.0000	347.0000	770.0000	347.0000	770.0000	222.2904
Manganese Background	8	104.5000	104.5000	101.0000	108.0000	102.5000	106.5000	2.4495

Table 53

Table 54 contains the descriptive statistics for the central Selenium concentrations. The background selenium concentrations are all non-detect with detection limits ranging from 1.3-0.64. From the descriptive statistics it can be seen that the maximum concentration from the central selenium concentrations is less than the lowest background detection limit. It should also be noticed that the mean, median, and upper quartile central concentrations are less than the lowest background detection limit. Therefore, the central selenium concentrations do not appear greater than the background concentrations.

Variable	Descriptive Statistics UXO 7 Central Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Selenium Central	3	0.508667	0.546000	0.405000	0.575000	0.405000	0.575000	0.090941

Table 54

Table 55 contains the summary statistics for the thallium central and background concentrations.

From this table it can be seen that the mean, minimum, and lower quartile central concentrations are slightly less the corresponding background concentrations; the median, maximum and upper quartile central concentrations are slightly higher than the background thallium concentrations. With a sample size of 3 for the central thallium concentrations, only a simple comparison of descriptive statistics is an applicable. From these descriptive statistics it appears that the central thallium concentrations are not greater than the background concentrations.

	Descriptive Statistics UXO 7 Central							
Variable	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev
Thallium Central	3	0.192667	0.209000	0.138000	0.231000	0.138000	0.231000	0.04860
Thallium Background	8	0.186250	0.175000	0.150000	0.220000	0.165000	0.220000	0.02924

Table 55

APPENDIX F

BACKGROUND STATISTICAL COMPARISONS
SOUTHERN ZONE – UXO 7
NSWC CRANE
CRANE, INDIANA

The remaining background comparisons were completed by dividing the site into three locations (Southern, Northern, and Central). The background comparisons were done by examining descriptive statistics, boxplots, means plots, and if need a formal statistical test of differences.

Table 38 contains the descriptive statistics for south and the background cobalt concentrations. From this table it can be seen that the mean, median, minimum, maximum, and lower and upper quartile south concentrations are slightly higher than the background concentrations.

Variable	Descriptive Statistics UXO 7 South							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev
Cobalt South	8	15.48750	14.80000	11.40000	21.90000	12.95000	17.55000	3.40983
Cobalt Background	8	13.72500	13.60000	8.40000	27.10000	8.75000	14.80000	6.08786

Table 38

Figure 97 contains the side by side box plots for the south and the background concentrations. From this plot it can be seen that the lower quartile south concentration is less than the background median concentration. It can also be noticed that the median south concentration is at roughly the same concentration as the background upper quartile. The difference between south and background median concentrations and south and background mean concentrations are around 2 mg/kg.

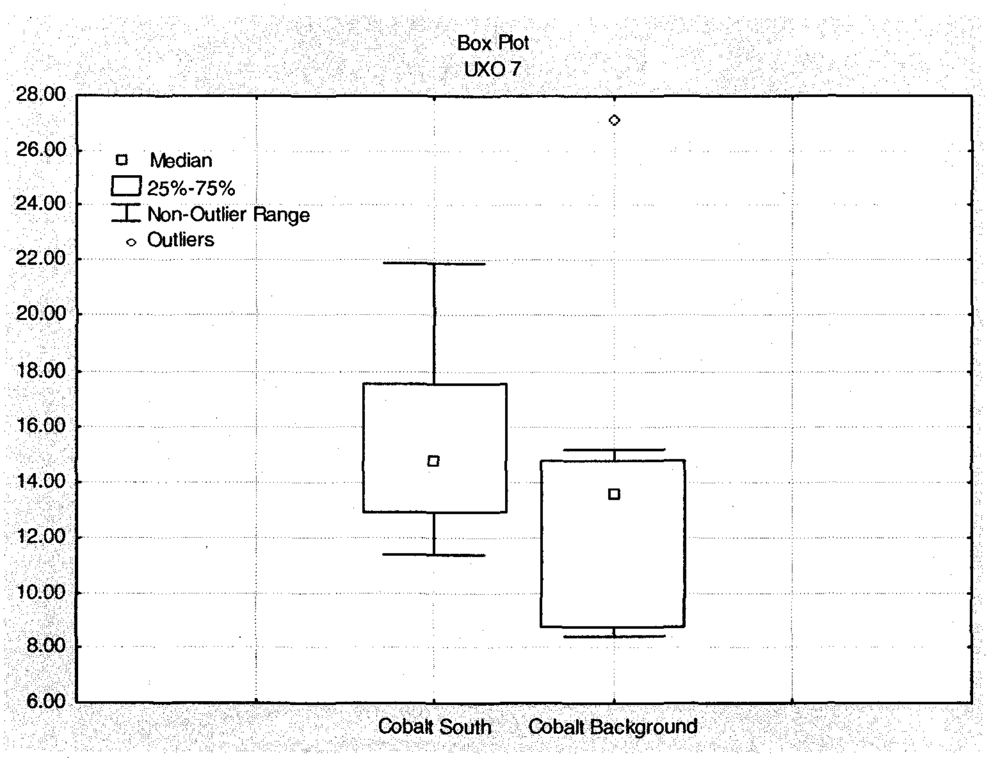


Figure 97

Figure 98 contains the side by side means plots for the south and the background concentrations. From this plot it can be seen that the south mean concentration is greater than the background mean concentration. It can also be seen that the upper confidence limit for the south concentrations is lower than the upper confidence limit for the background.

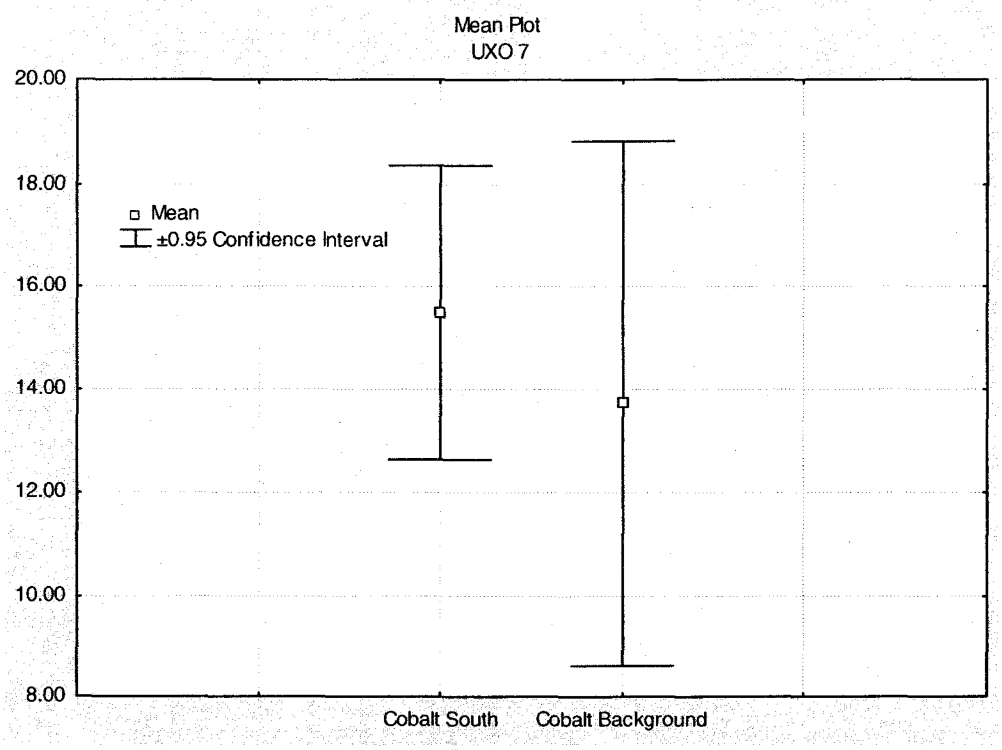


Figure 98

Figure 99 contains the normal probability plot for the south cobalt concentrations. From this plot it can be seen that the data follow the line and that the corresponding pvalue for the Shapiro Wilk test is 0.69. Therefore the south concentrations are not normally distributed. From Figure 37 it was concluded that the cobalt background concentrations are not normally distributed.

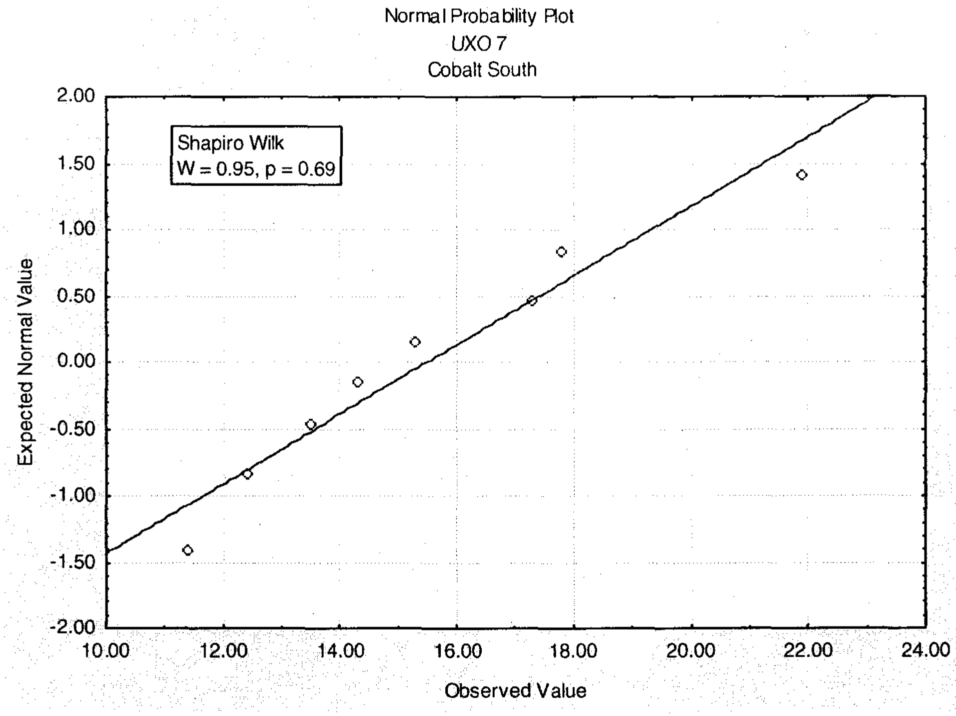


Figure 99

Table 39 contains the Test Statistic and corresponding p value for Levene's test for equality of variance. The Levene Test tests the hypothesis that the variances of the Site and Background Concentrations are equal. If the p-value for Levene's test is less than 0.05 than the variances of the distributions are not equal. From Table 39 it can be seen that the p-value for Levene's Test is 0.48 so the variances of the South and Background Coblat Concentrations are equal.

Levene's Test	
Levene F(1,df)	.53
Degrees of freedom (df)	14
p-value	0.48

Table 39

Because the site and background concentrations are not normally distributed and the variances are equal, the Wilcoxon Rank Sum Test was used to determine if there are differences between the two data sets. The Wilcoxon Rank Sum Test tests the hypothesis that the south cobalt concentrations are equal to the background cobalt concentrations. Table 40 contains the Test Statistic and corresponding p value for the Wilcoxon Rank Sum Test, because the pvalue is greater than 0.05 we fail to reject the null that there is no difference between the background and site concentrations.

Wilcoxon Rank Sum Test	
Test Statistic	42.5
P Value	>.10

Table 40

Table 41 contains the descriptive statistics for manganese. From this table it can be seen that the mean, median, maximum, and upper quartile south concentrations are less than the background concentrations.

Variable	Descriptive Statistics UXO 7 South							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Manganese South	8	1033.875	962.000	694.0000	1370.000	841.5000	1300.000	259.8595
Manganese Background	8	1417.250	1405.000	666.0000	3040.000	786.0000	1625.000	765.2654

Table 41

Figure 100 contains the side by side box plots for manganese. From this plot it can be seen that the lower quartile of the site copper concentrations is higher than the lower quartile for the background concentrations. It can also be seen that the south median and upper quartile concentrations are less than the background median concentrations.

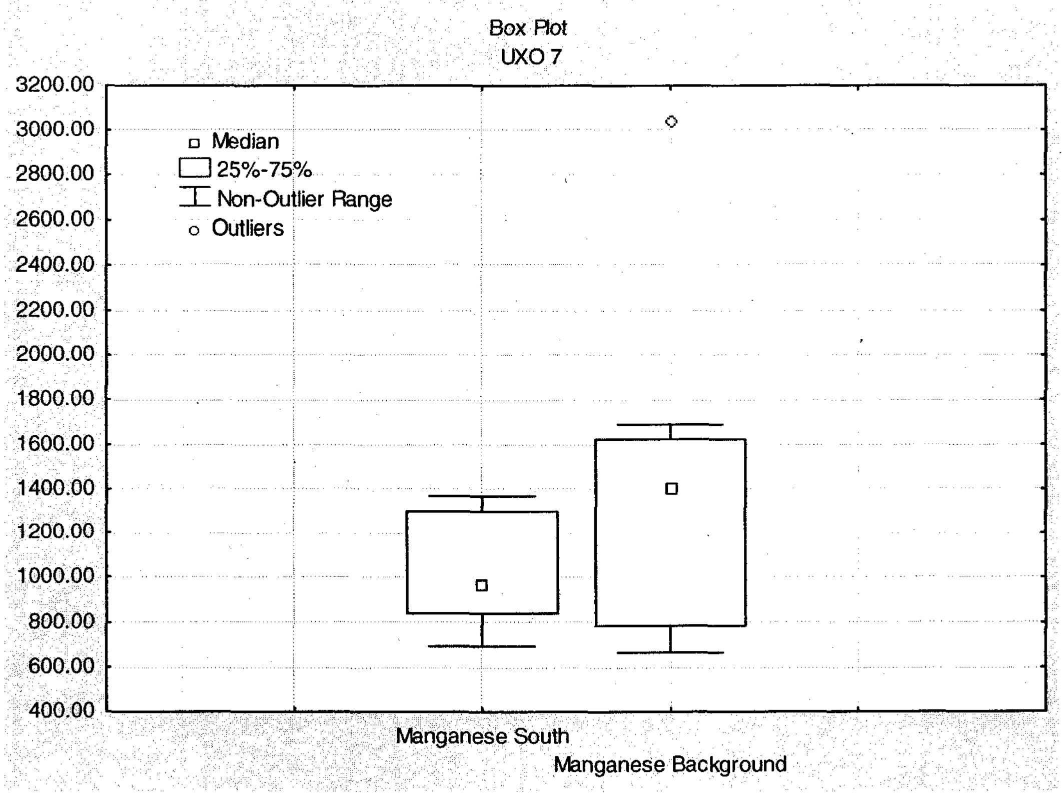


Figure 100

Figure 101 shows the side by side means plots. From this figure it can be seen that the site mean concentration is lower than the mean background concentration. The Upper Confidence limit of the south manganese concentrations is less than the mean background concentration.

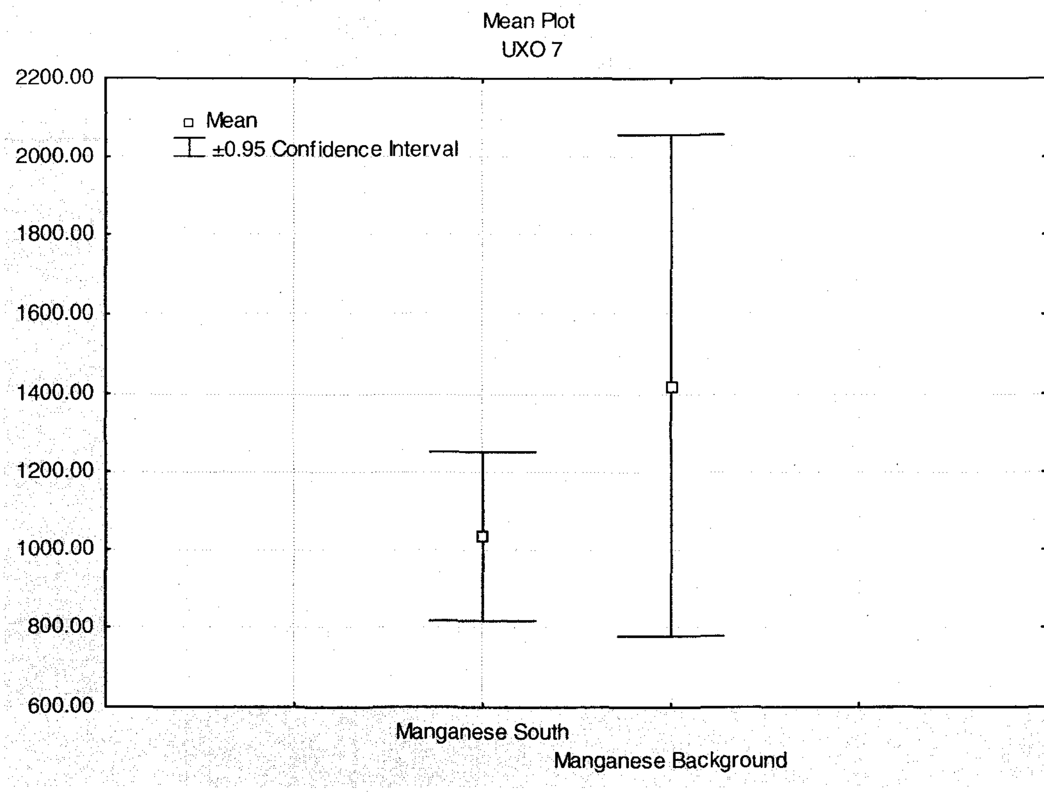


Figure 101

Figure 102 shows the normal probability plots for the south site concentrations respectively. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on these plot is the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 102 it can be seen that the site data roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.28. Therefore it is concluded that the south data is normally distributed. From Figure 58 it can be seen that the site data do not roughly follows the line and that the p value for the corresponding Shapiro Wilk test is 0.10. Therefore it is concluded that the background data is not normally distributed.

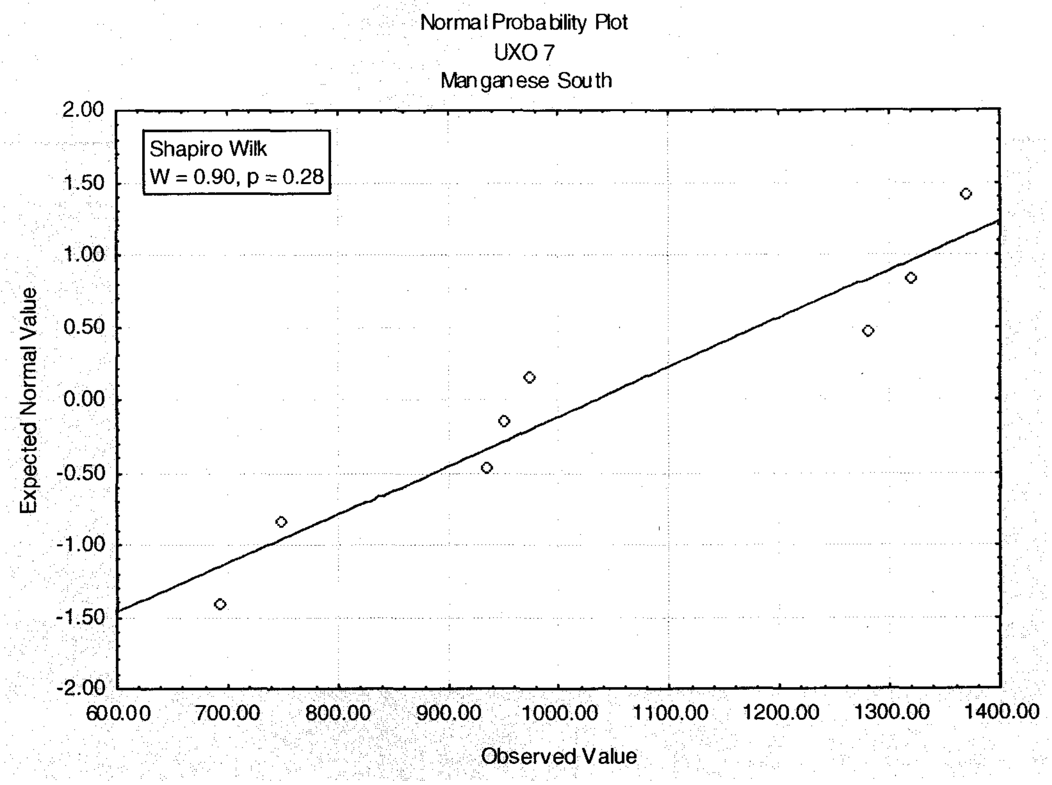


Figure 102

Table 42 contains the Test Statistic and corresponding p value for Levene's test for equality of variance. The Levene Test tests the hypothesis that the variances of the South and Background Concentrations are equal. If the p-value for Levene's test is less than 0.05 than the variances of the distributions are not equal. From Table 42 it can be seen that the p-value for Levene's Test is 0.15 so the variances of the South and Background Manganese Concentrations are equal.

Levene's Test	
Levene F(1,df)	2.34
Degrees of freedom (df)	14
p-value	0.15

Table 42

Because the south concentrations are normally distributed and background concentrations are only slightly not normally distributed and the variances are equal, the two sample t test was used to determine if there are differences between the two data sets. It should be noted that the two sample t test is robust to slight departures in non-normality. The Two Sample T Test tests the hypothesis that the south manganese concentrations are equal to the background manganese concentrations. Table 43 contains the Test Statistic and corresponding Critical Value for the Two-Sample T test, because the test statistic is not greater than the critical value at the 0.05 level we fail to reject the null that there is no difference between the background and site concentrations.

Two Sample T test	
Test Statistic	-1.37
Critical Value	1.76

Table 43

Table 44 contains the descriptive statistics for Thallium. From this table it can be seen that the mean, median, minimum, and lower and upper quartile south concentrations are slightly less than the background concentrations.

Variable	Descriptive Statistics UXO 7 South							
	Valid N	Mean	Median	Minimum	Maximum	Lower Quartile	Upper Quartile	Std.Dev.
Thallium South	8	0.172975	0.174500	0.080800	0.250000	0.147500	0.204500	0.050654
Thallium Background	8	0.186250	0.175000	0.150000	0.220000	0.165000	0.220000	0.029246

Table 44

Figure 103 contains the side by side box plots for Thallium. From this table it can be seen that the median site concentrations are extremely similar and that the lower quartile and upper quartile south concentrations are less than the background the background concentrations.

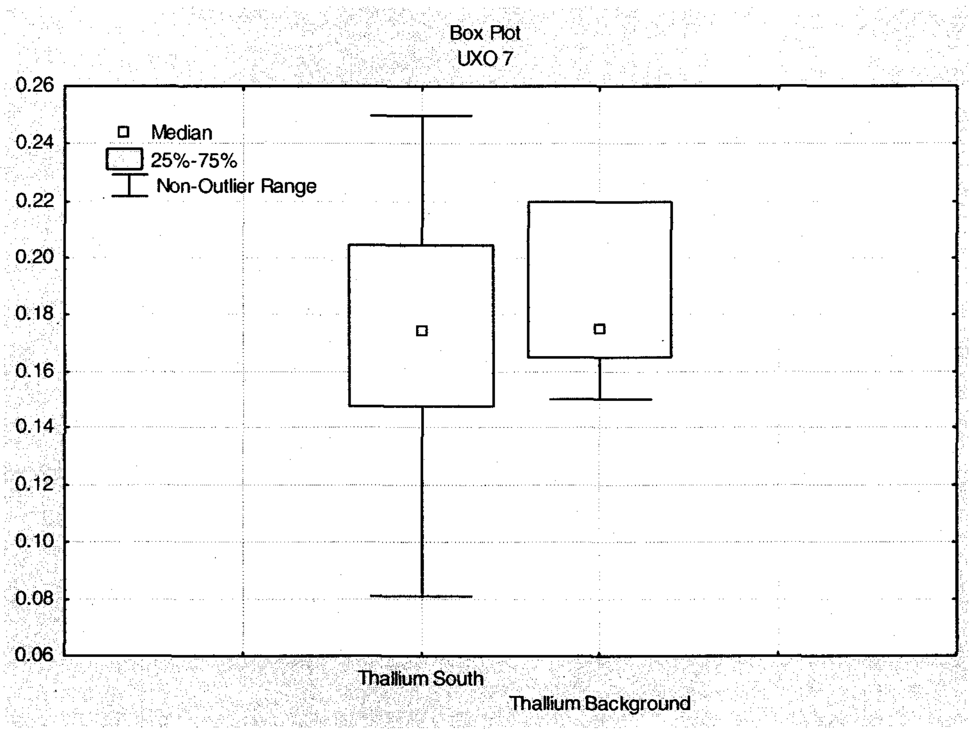


Figure 103

Figure 104 contains the side by side mean plot for the thallium south and background concentrations. From figure 104 it can be seen that the south thallium mean is less than the background mean. It can also be seen that the confidence interval for the south thallium concentrations is larger than the background confidence interval.

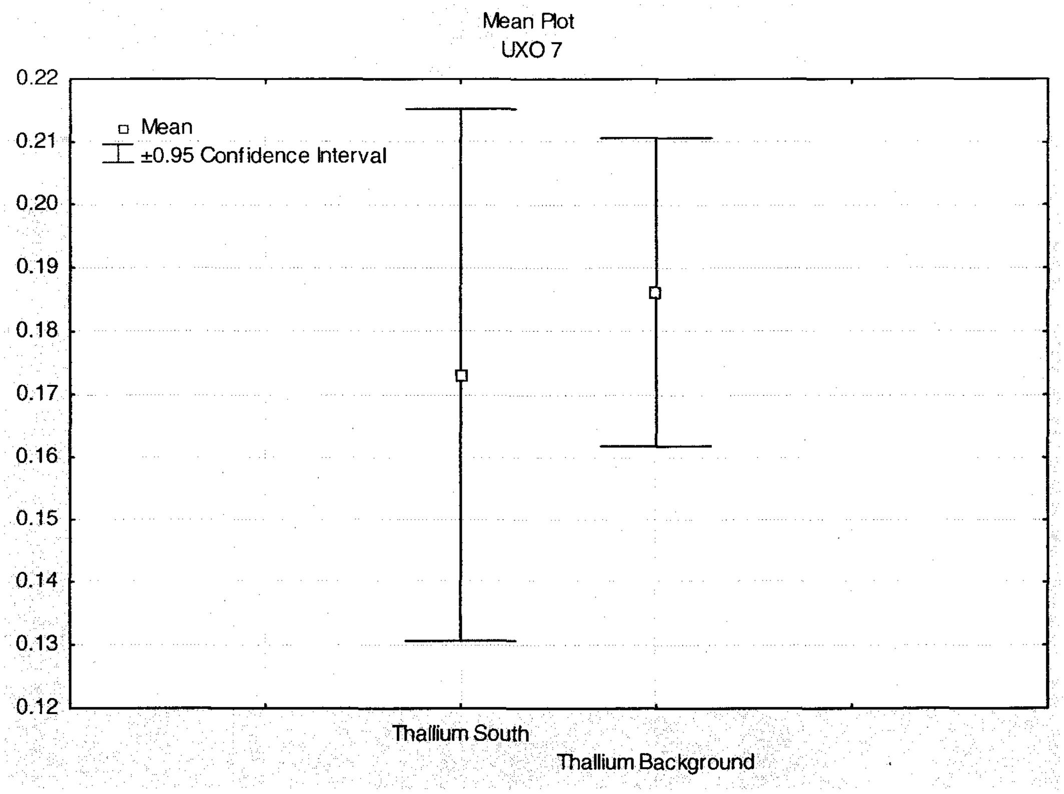


Figure 104

Figure 105 shows the normal probability plot for the south thallium concentrations. If the data is normally distributed the data will roughly follow the line drawn on the probability plot. Also displayed on the plot is the corresponding Shapiro Wilk Test. The Shapiro Wilk test tests the hypothesis that the data are normally distributed. If the p-value for the Shapiro Wilk test is less than 0.05 then the hypothesis that the data are normally distributed is rejected. From Figure 105 it can be seen that the background roughly follow the line and that the p value for the corresponding Shapiro Wilk test is 0.94. Therefore it is concluded that the thallium south data is normally distributed. From Figure 81 it can be seen that the background data were slightly non-normal with a pvalue of 0.06 with a slight step pattern in the distribution of the data.

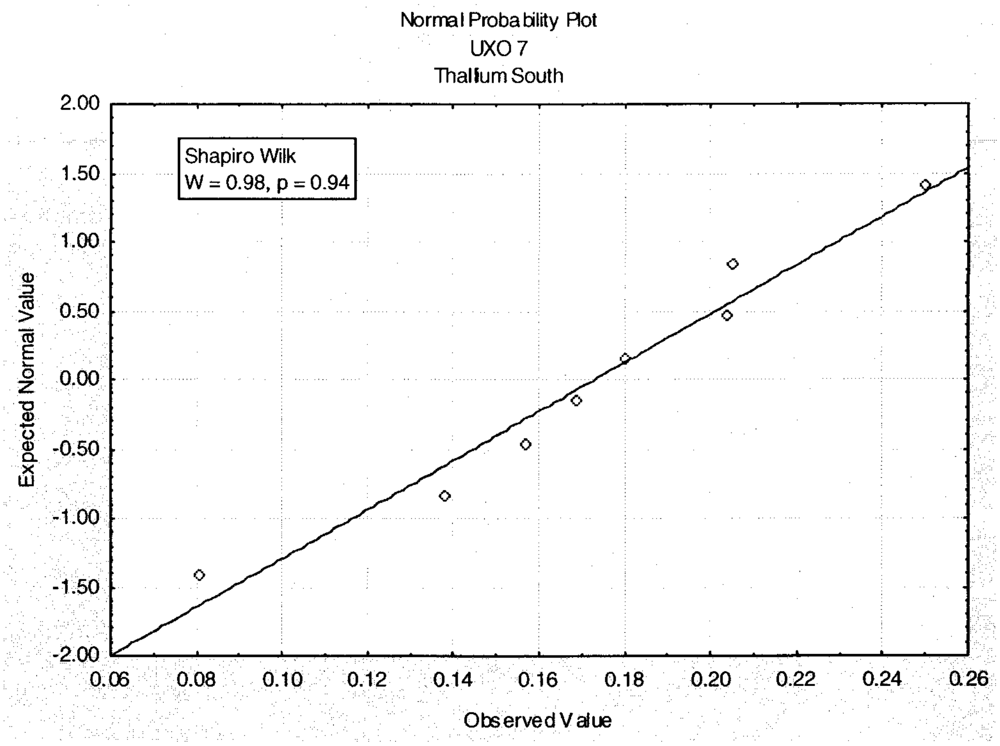


Figure 105

Table 45 contains the Test Statistic and corresponding p value for Levene's test for equality of variance. The Levene Test tests the hypothesis that the variances of the Site and Background Concentrations are equal. If the p-value for Levene's test is less than 0.05 than the variances of the distributions are not equal. From Table 32 it can be seen that the p-value for Levene's Test is 0.35 so the variances of the South and Background thallium Concentrations are equal.

Levene's Test	
Levene F(1,df)	0.92
Degrees of freedom (df)	14
p-value	0.35

Table 45

Because the south concentrations are normally distributed and background concentrations are only slightly not normally distributed and the variances are equal, the two sample t test was used to determine if there are differences between the two data sets. It should be noted that the two sample t test is robust to slight departures in non-normality. The Two Sample T Test tests the hypothesis that the south manganese concentrations are equal to the background manganses concentrations. Table 46 contains the Test Statistic and corresponding Critical Value for the Two-Sample T test, because the test statistic is not greater than the critical value (at the 0.05 level) we fail to reject the null that there is no difference between the background and south concentrations.

Two Sample T test	
Test Statistic	-1.024
Critical Value	1.761

Table 46

ANALYTICAL RESULTS
NORTHERN ZONE - UXO 7
NSWC CRANE, CRANE, INDIANA

nsample	X7SS0380002	X7SS0390002	X7SS0400002	X7SS0410002	X7SS0420002	X7SS0430002	X7SS0440002	X7SS0450002	X7SS0460002	X7SS0470002	X7SS0480002	X7SS0490002
location	X7-SB038	X7-SB039	X7-SB040	X7-SB041	X7-SB042	X7-SB043	X7-SB044	X7-SB045	X7-SB046	X7-SB047	X7-SB048	X7-SB049
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0380002	X7SS0390002	X7SS0400002	X7SS0410002	X7SS0420002	X7SS0430002	X7SS0440002	X7SS0450002	X7SS0460002	X7SS0470002	X7SS0480002	X7SS0490002
sample_date	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**	**c_006**	**c_007**	**c_008**	**c_009**	**c_010**	**c_011**	c_012
Inorganics (mg/kg)												
ALUMINUM		15300					14900	13400	16300		15700	
ANTIMONY		96.2 J					4.5 J	3.9 J	24.5 J		5.6 J	
ARSENIC		7.20					6.34	7.72	7.38		7.50	
BARIUM		91.2					61.0	69.4	85.3		80.9	
BERYLLIUM		0.637					0.553	0.601	0.776		0.612	
CADMIUM		0.895					0.462	0.387	0.594		1.05	
CALCIUM		26700					735	917	3670		1300	
CHROMIUM		20.4					24.1	27.4	23.4		23.2	
COBALT		9.72					12.1	13.7	12.0		12.5	
COPPER		94.6					96.1	128	283		93.5	
IRON		26600					32100	38600	22900		26600	
LEAD, LABCONV	213.49	400.26	118.89	26.34	20.0 U	56.28	203.43	607.08	770.55	63.49	142.15	23.87
LEAD, LABEQV	213.49	495.00	118.89	26.34	20.00 U	56.28	199.00	286.00	1100.00	63.49	190.00	23.87
LEAD, RAWXRF	213.33	382.00	124.00	30.67	20.00 U	62.00	204.00	562.00	701.00	69.33	146.33	28.00
MAGNESIUM		7000					1680	1610	2760		1720	
MANGANESE		737					709	919	1060		461	
NICKEL		14.5					11.7	14.0	15.7		13.7	
POTASSIUM		1100					852	788	1100		894	
SELENIUM		0.406					0.249	0.273	0.368		0.365	
SILVER		0.109					0.0640	0.0695	0.115		0.100	
SODIUM		65.3 U					59.2 U	16.1 U	34.1 U		44.4 U	
THALLIUM		0.197					0.170	0.181	0.223		0.197	
VANADIUM		32.1					32.5	34.7	35.9		36.9	
ZINC		89.8					50.3	52.3	79.4		54.1	

ANALYTICAL RESULTS
NORTHERN ZONE - UXO 7
NSWC CRANE, CRANE, INDIANA

nsample	X7SS0500002	X7SS0510002	X7SS0520002	X7SS0530002	X7SS0540002	X7SS0550002	X7SS0560002	X7SS0570002	X7SS1730002	X7SS1740002	X7SS1750002	X7SS1760002
location	X7-SB050	X7-SB051	X7-SB052	X7-SB053	X7-SB054	X7-SB055	X7-SB056	X7-SB057	X7-SB173	X7-SB174	X7-SB175	X7-SB176
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0500002	X7SS0510002	X7SS0520002	X7SS0530002	X7SS0540002	X7SS0550002	X7SS0560002	X7SS0570002	X7SS1730002	X7SS1740002	X7SS1750002	X7SS1760002
sample_date	20071003	20071003	20071003	20071004	20071004	20071006	20071004	20071004	20071007	20071007	20071007	20071007
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_013**	**c_014**	**c_015**	**c_016**	**c_017**	**c_018**	**c_019**	**c_020**	**c_021**	**c_022**	**c_023**	**c_024**
Inorganics (mg/kg)												
ALUMINUM						11400			10900	10600	9300	
ANTIMONY						37.9 J			3.7 J	12.3 J	3.3 J	
ARSENIC						10.8			11.5	8.80	15.2	
BARIUM						86.1			91.4	87.9	90.6	
BERYLLIUM						0.715			0.950	0.741	0.905	
CADMIUM						1.27			1.26	1.34	2.21	
CALCIUM						1080			1350	1420	1430	
CHROMIUM						18.6			20.7	19.1	18.1	
COBALT						14.9			12.9	14.3	17.6	
COPPER						197			30.8	98.7	59.7	
IRON						26700			44000	20900	51900	
LEAD, LABCONV	56.94	30.37	34.13	32.25	26.64	818.09	20.0 U	20.0 U	116.13	468.87	90.20	143.19
LEAD, LABEQV	56.94	30.37	34.13	32.25	26.64	1160.00	20.00 U	20.00 U	125.00	430.00	170.00	143.19
LEAD, RAWXRF	62.67	35.00	39.00	37.00	31.00	741.00	20.00 U	20.00 U	121.33	442.33	96.00	147.33
MAGNESIUM						1040			1160	1040	723	
MANGANESE						1110			1060	912	1310	
NICKEL						18.6			22.6	19.1	25.9	
POTASSIUM						579			754	782	768	
SELENIUM						0.663			0.631	0.546	0.743	
SILVER						0.161			0.136	0.165	0.141	
SODIUM						40.5 U			83.9 U	58.5 U	31.1 U	
THALLIUM						0.171			0.162	0.158	0.141	
VANADIUM						32.0			38.9	27.2	31.0	
ZINC						77.9			61.0	64.0	118	

ANALYTICAL RESULTS
NORTHERN ZONE - UXO 7
NSWC CRANE, CRANE, INDIANA

nsample	X7SS1770002	X7SS1780002	X7SS1790002	X7SS1800002	X7SS1810002	X7SS1820002	X7SS1830002	X7SS1840002	X7SS1890002	X7SS1900002
location	X7-SB177	X7-SB178	X7-SB179	X7-SB180	X7-SB181	X7-SB182	X7-SB183	X7-SB184	X7-SB189	X7-SB190
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1770002	X7SS1780002	X7SS1790002	X7SS1800002	X7SS1810002	X7SS1820002	X7SS1830002	X7SS1840002	X7SS1890002	X7SS1900002
sample_date	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071009	20071009
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_025**	**c_026**	**c_027**	**c_028**	**c_029**	**c_030**	**c_031**	**c_032**	**c_033**	**c_034**
Inorganics (mg/kg)										
ALUMINUM	15200	15500	11500	16200	14800	11700	19400	15600	10000	
ANTIMONY	2.6 J	0.98 J	2.0 J	2.1 J	5.3 J	2.8 J	0.59 U	0.38 U	2.6 J	
ARSENIC	10.8	8.86	11.0	15.0	8.77	15.1	17.0	12.5	5.52	
BARIUM	59.9	82.8	56.2	81.8	118	61.5	92.9	73.7	82.8	
BERYLLIUM	0.780	0.594	0.769	0.827 J	1.20	0.703 J	0.718 J	0.625 J	0.860	
CADMIUM	0.993	0.969	0.439	1.32	0.572	0.823	1.90	1.32	0.815	
CALCIUM	1330	1360	1110	1020	1080	1040	18700	1790	1130	
CHROMIUM	57.0	30.1	39.2	32.2	45.9	35.2	28.5	21.1	16.7	
COBALT	15.0	20.8	14.4	19.2	11.2	22.8	16.9	18.6	13.3	
COPPER	48.1	16.9	29.2	51.9	63.8	44.2	48.2	33.8	46.3	
IRON	45000	30600	38400	31500	35800	45700	29700	24700	23200	
LEAD, LABCONV	109.27	25.41	98.34	78.77	201.63	103.45	20.82	21.74	162.52	347.03
LEAD, LABEQV	115.00	40.90	83.60	89.00	212.00	95.10	28.80	25.30	151.00	347.03
LEAD, RAWXRF	114.67	29.67	104.00	84.67	202.33	109.00	24.67	25.67	165.67	334.67
MAGNESIUM	1580	1420	1190	2280	1810	1140	3910	2620	1020	
MANGANESE	502	821	637	544	571	641	334	477	665	
NICKEL	17.3	16.3	13.6	27.0	32.4	22.1	29.7	24.3	19.6	
POTASSIUM	882	884	592	1210	715	810	1740	1180	660	
SELENIUM	0.365	0.430	0.322	0.604	0.279	0.373	0.913	0.367	0.383	
SILVER	0.0996	0.0894	0.0593	0.186	0.0620	0.0985	0.238	0.152	0.126	
SODIUM	50.1 U	43.9 U	23.8 U	138	19.1 U	40.9	138	93.5	64.7 U	
THALLIUM	0.175	0.180	0.147	0.390	0.133	0.224	0.525	0.394	0.128 U	
VANADIUM	44.1	39.8	35.9	78.0	73.2	57.0	85.9	64.3	25.6	
ZINC	53.1	40.7	42.2	74.8	96.5	47.0	74.3	61.0	61.8	

ANALYTICAL RESULTS
SOUTHERN ZONE - UXO 7
NSWC CRANE, CRANE, INDIANA

nsample	X7SS0010002	X7SS0020002	X7SS0030002	X7SS0040002	X7SS0050002	X7SS0060002	X7SS0070002	X7SS0080002	X7SS0090002	X7SS0100002
location	X7-SB001	X7-SB002	X7-SB003	X7-SB004	X7-SB005	X7-SB006	X7-SB007	X7-SB008	X7-SB009	X7-SB010
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0010002	X7SS0020002	X7SS0030002	X7SS0040002	X7SS0050002	X7SS0060002	X7SS0070002	X7SS0080002	X7SS0090002	X7SS0100002
sample_date	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**	**c_006**	**c_007**	**c_008**	**c_009**	**c_010**
Inorganics (mg/kg)										
ALUMINUM		12800	7910	8600						
ANTIMONY		0.71 U	5.8 J	11.1 J						
ARSENIC		12.9	16.4	9.34						
BARIU M		110	907	949						
BERYLLIUM		0.820	1.35	0.670						
CADMIUM		0.683	1.09	0.923						
CALCIUM		2500	4430	1810						
CHROMIUM		24.6	66.6	25.0						
COBALT		21.9	14.3	13.5						
COPPER		20.5	21.7	33.8						
IRON		40200	90700	37600						
LEAD, LABCONV	44.14	55.30	95.97	257.71	68.45	20.0 U	20.0 U	37.29	41.74	82.80
LEAD, LABEQV	44.14	22.80	140.00	125.00	68.45	20.00 U	20.00 U	37.29	41.74	82.80
LEAD, RAWXRF	49.50	61.00	101.67	254.00	74.33	20.00 U	20.00 U	42.33	47.00	88.67
MAGNESIUM		2340	923	999						
MANGANESE		694	974	749						
NICKEL		28.7	50.2	16.8						
POTASSIUM		1790	626	1040						
SELENIUM		0.650	0.559	0.460						
SILVER		0.102	0.117	0.113						
SODIUM		75.7 U	22.7 U	21.1 U						
THALLIUM		0.250	0.0808	0.138						
VANADIUM		29.6	46.3	23.7						
ZINC		59.3	110	111						

ANALYTICAL RESULTS
SOUTHERN ZONE - UXO 7
NSWC CRANE, CRANE, INDIANA

nsample	X7SS0110002	X7SS0120002	X7SS0130002	X7SS0140002	X7SS0150002	X7SS0160002	X7SS0170002	X7SS0180002	X7SS0190002	X7SS0200002
location	X7-SB011	X7-SB012	X7-SB012	X7-SB014	X7-SB015	X7-SB016	X7-SB017	X7-SB018	X7-SB019	X7-SB020
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0110002	X7SS0120002	X7SS0130002	X7SS0140002	X7SS0150002	X7SS0160002	X7SS0170002	X7SS0180002	X7SS0190002	X7SS0200002
sample_date	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002	20071002
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_011**	**c_012**	**c_013**	**c_014**	**c_015**	**c_016**	**c_017**	**c_018**	**c_019**	**c_020**
Inorganics (mg/kg)										
ALUMINUM		14000							13300	
ANTIMONY		1.6 J							3.7 J	
ARSENIC		7.93							5.69	
BARIU M		95.6							118	
BERYLLIUM		0.909							0.873	
CADMIUM		0.959							0.712	
CALCIUM		13400							4700	
CHROMIUM		22.3							21.0	
COBALT		11.4							12.4	
COPPER		30.9							427	
IRON		37200							29200	
LEAD, LABCONV	20.0 U	40.47	44.31	55.30	33.19	34.13	43.98	108.24	259.16	29.13
LEAD, LABEQV	20.00 U	43.90	44.31	55.30	33.19	34.13	43.98	108.24	537.00	29.13
LEAD, RAWXRF	20.00 U	45.67	49.67	61.00	38.00	39.00	49.33	113.67	255.33	33.67
MAGNESIUM		2130							1950	
MANGANESE		1370							950	
NICKEL		17.8							24.8	
POTASSIUM		1190							1780	
SELENIUM		0.618							0.553	
SILVER		0.110							0.105	
SODIUM		36.8 U							57.8 U	
THALLIUM		0.204							0.157	
VANADIUM		34.9							27.1	
ZINC		68.1							148	

ANALYTICAL RESULTS
SOUTHERN ZONE - UXO 7
NSWC CRANE, CRANE, INDIANA

nsample	X7SS1420002	X7SS1430002	X7SS1440002	X7SS1450002	X7SS1460002	X7SS1470002	X7SS1480002	X7SS1490002	X7SS1500002	X7SS1510002
location	X7-SB142	X7-SB143	X7-SB144	X7-SB145	X7-SB146	X7-SB147	X7-SB148	X7-SB149	X7-SB150	X7-SB151
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1420002	X7SS1430002	X7SS1440002	X7SS1450002	X7SS1460002	X7SS1470002	X7SS1480002	X7SS1490002	X7SS1500002	X7SS1510002
sample_date	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_021**	**c_022**	**c_023**	**c_024**	**c_025**	**c_026**	**c_027**	**c_028**	**c_029**	**c_030**
Inorganics (mg/kg)										
ALUMINUM							13700			
ANTIMONY							1.2 J			
ARSENIC							7.41			
BARIU M							153			
BERYLLIUM							0.859			
CADMIUM							1.32			
CALCIUM							5560			
CHROMIUM							18.7			
COBALT							15.3			
COPPER							26.6			
IRON							22400			
LEAD, LABCONV	26.34	36.66	20.0 U	55.96	34.44	65.14	143.90	49.78	26.02	24.49
LEAD, LABEQV	26.34	36.66	20.00 U	55.96	34.44	65.14	71.80	49.78	26.02	24.49
LEAD, RAWXRF	30.67	41.67	20.00 U	61.67	39.33	71.00	148.00	55.33	30.33	28.67
MAGNESIUM							2100			
MANGANESE							1320			
NICKEL							21.4			
POTASSIUM							1730			
SELENIUM							0.661			
SILVER							0.0984			
SODIUM							106 U			
THALLIUM							0.180			
VANADIUM							28.1			
ZINC							58.5			

ANALYTICAL RESULTS
SOUTHERN ZONE - UXO 7
NSWC CRANE, CRANE, INDIANA

nsample	X7SS1520002	X7SS1530002	X7SS1540002	X7SS1550002	X7SS1560002	X7SS1570002	X7SS1580002	X7SS1590002	X7SS1600002	X7SS1610002
location	X7-SB152	X7-SB153	X7-SB154	X7-SB155	X7-SB156	X7-SB157	X7-SB158	X7-SB159	X7-SB160	X7-SB161
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1520002	X7SS1530002	X7SS1540002	X7SS1550002	X7SS1560002	X7SS1570002	X7SS1580002	X7SS1590002	X7SS1600002	X7SS1610002
sample_date	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_031**	**c_032**	**c_033**	**c_034**	**c_035**	**c_036**	**c_037**	**c_038**	**c_039**	**c_040**
Inorganics (mg/kg)										
ALUMINUM	12800									
ANTIMONY	6.1 J									
ARSENIC	7.84									
BARIU M	134									
BERYLLIUM	0.888									
CADMIUM	1.25									
CALCIUM	18000									
CHROMIUM	23.0									
COBALT	17.3									
COPPER	66.3									
IRON	27300									
LEAD, LABCONV	250.42	65.81	21.12	21.74	22.95	36.34	22.95	20.67	26.34	67.13
LEAD, LABEQV	460.00	65.81	21.12	21.74	22.95	36.34	22.95	20.67	26.34	67.13
LEAD, RAWXRF	247.33	71.67	25.00	25.67	27.00	41.33	27.00	24.50	30.67	73.00
MAGNESIUM	5840									
MANGANESE	1280									
NICKEL	26.6									
POTASSIUM	1550									
SELENIUM	0.717									
SILVER	0.105									
SODIUM	68.9 U									
THALLIUM	0.169									
VANADIUM	31.2									
ZINC	72.9									

nsample	X7SS1620002	X7SS1630002	X7SS1640002	X7SS1650002	X7SS1660002	X7SS1670002	X7SS1680002	X7SS1690002	X7SS1700002	X7SS1710002
location	X7-SB162	X7-SB163	X7-SB164	X7-SB165	X7-SB166	X7-SB167	X7-SB168	X7-SB169	X7-SB170	X7-SB171
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1620002	X7SS1630002	X7SS1640002	X7SS1650002	X7SS1660002	X7SS1670002	X7SS1680002	X7SS1690002	X7SS1700002	X7SS1710002
sample_date	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007	20071007
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_041**	**c_042**	**c_043**	**c_044**	**c_045**	**c_046**	**c_047**	**c_048**	**c_049**	c_050
Inorganics (mg/kg)										
ALUMINUM						18400				
ANTIMONY						0.73 J				
ARSENIC						10.6				
BARIU M						138				
BERYLLIUM						1.13				
CADMIUM						1.79				
CALCIUM						3100				
CHROMIUM						28.6				
COBALT						17.8				
COPPER						36.9				
IRON						36100				
LEAD, LABCONV	193.05	65.81	128.57	123.73	45.27	95.28	36.66	14.82	239.88	20.51
LEAD, LABEQV	193.05	65.81	128.57	123.73	45.27	72.20	36.66	14.82	239.88	20.51
LEAD, RAWXRF	194.33	71.67	133.33	128.67	50.67	101.00	41.67	18.00	237.67	24.33
MAGNESIUM						1860				
MANGANESE						934				
NICKEL						28.9				
POTASSIUM						2380				
SELENIUM						0.810				
SILVER						0.144				
SODIUM						75.8 U				
THALLIUM						0.205				
VANADIUM						37.4				
ZINC						86.4				

ANALYTICAL RESULTS
CENTRAL ZONE - UXO 7
NSWC CRANE, CRANE, INDIANA

nsample	X7SS0210002	X7SS0220002	X7SS0230002	X7SS0240002	X7SS0250002	X7SS0260002	X7SS0270002	X7SS0280002	X7SS0290002	X7SS0300002	X7SS0310002	X7SS0320002	X7SS0330002	X7SS0340002
location	X7-SB021	X7-SB022	X7-SB023	X7-SB024	X7-SB025	X7-SB026	X7-SB027	X7-SB028	X7-SB029	X7-SB030	X7-SB031	X7-SB032	X7-SB033	X7-SB034
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0210002	X7SS0220002	X7SS0230002	X7SS0240002	X7SS0250002	X7SS0260002	X7SS0270002	X7SS0280002	X7SS0290002	X7SS0300002	X7SS0310002	X7SS0320002	X7SS0330002	X7SS0340002
sample_date	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003	20071003
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**	**c_006**	**c_007**	**c_008**	**c_009**	**c_010**	**c_011**	**c_012**	**c_013**	**c_014**
Semivolatile Organics (ug/kg)														
2-METHYLNAPHTHALENE														
ACENAPHTHENE														
ACENAPHTHYLENE														
ANTHRACENE														
BENZO(A)ANTHRACENE														
BENZO(A)PYRENE														
BENZO(B)FLUORANTHENE														
BENZO(G,H,I)PERYLENE														
BENZO(K)FLUORANTHENE														
CHRYSENE														
DIBENZO(A,H)ANTHRACENE														
FLUORANTHENE														
FLUORENE														
INDENO(1,2,3-CD)PYRENE														
NAPHTHALENE														
PHENANTHRENE														
PYRENE														
Inorganics (mg/kg)														
ALUMINUM														
ANTIMONY														
ARSENIC														
BARIUM														
BERYLLIUM														
CADMIUM														
CALCIUM														
CHROMIUM														
COBALT														
COPPER														
IRON														
LEAD, LABCONV	31.31	20.0 U	25.72	25.72	29.44	24.79	20.0 U	26.18	20.0 U	43.35	32.25	29.13	27.57	20.0 U
LEAD, LABEQV	31.31	20.00 U	25.72	25.72	29.44	24.79	20.00 U	26.18	20.00 U	43.35	32.25	29.13	27.57	20.00 U
LEAD, RAWXRF	36.00	20.00 U	30.00	30.00	34.00	29.00	20.00 U	30.50	20.00 U	48.67	37.00	33.67	32.00	20.00 U
MAGNESIUM														
MANGANESE														
NICKEL														
POTASSIUM														
SELENIUM														
SILVER														
SODIUM														
THALLIUM														
VANADIUM														
ZINC														

nsample	X7SS0350002	X7SS0360002	X7SS0370002	X7SS0580002	X7SS0590002	X7SS0600002	X7SS0610002	X7SS0620002	X7SS0630002	X7SS0640002	X7SS0650002	X7SS0660002	X7SS0670002	X7SS0680002
location	X7-SB035	X7-SB036	X7-SB037	X7-SB058	X7-SB059	X7-SB060	X7-SB061	X7-SB062	X7-SB063	X7-SB064	X7-SB065	X7-SB066	X7-SB067	X7-SB068
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0350002	X7SS0360002	X7SS0370002	X7SS0580002	X7SS0590002	X7SS0600002	X7SS0610002	X7SS0620002	X7SS0630002	X7SS0640002	X7SS0650002	X7SS0660002	X7SS0670002	X7SS0680002
sample_date	20071003	20071003	20071003	20071006	20071004	20071004	20071004	20071004	20071004	20071004	20071004	20071004	20071004	20071004
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_015**	**c_016**	**c_017**	**c_018**	**c_019**	**c_020**	**c_021**	**c_022**	**c_023**	**c_024**	**c_025**	**c_026**	**c_027**	**c_028**
Semivolatile Organics (ug/kg)														
2-METHYLNAPHTHALENE														
ACENAPHTHENE														
ACENAPHTHYLENE														
ANTHRACENE														
BENZO(A)ANTHRACENE														
BENZO(A)PYRENE														
BENZO(B)FLUORANTHENE														
BENZO(G,H,I)PERYLENE														
BENZO(K)FLUORANTHENE														
CHRYSENE														
DIBENZO(A,H)ANTHRACENE														
FLUORANTHENE														
FLUORENE														
INDENO(1,2,3-CD)PYRENE														
NAPHTHALENE														
PHENANTHRENE														
PYRENE														
Inorganics (mg/kg)														
ALUMINUM												8700		
ANTIMONY												0.21 J		
ARSENIC												3.86		
BARIUM												163		
BERYLLIUM												0.407		
CADMIUM												0.662		
CALCIUM												763		
CHROMIUM												10.2		
COBALT												6.79		
COPPER												6.34		
IRON												12200		
LEAD, LABCONV	20.0 U	20.0 U	38.24	99.36	24.79	20.0 U	20.0 U	22.95	20.0 U	20.0 U	28.50	24.33	20.0 U	20.0 U
LEAD, LABEQV	20.00 U	20.00 U	38.24	99.36	24.79	20.00 U	20.00 U	22.95	20.00 U	20.00 U	28.50	10.30	20.00 U	20.00 U
LEAD, RAWXRF	20.00 U	20.00 U	43.33	105.00	29.00	20.00 U	20.00 U	27.00	20.00 U	20.00 U	33.00	28.50	20.00 U	20.00 U
MAGNESIUM												830		
MANGANESE												347		
NICKEL												8.75		
POTASSIUM												476		
SELENIUM												0.546		
SILVER												0.0627		
SODIUM												46.8		
THALLIUM												0.138		
VANADIUM												19.9		
ZINC												30.9		

nsample	X7SS0690002	X7SS0700002	X7SS0710002	X7SS0720002	X7SS0730002	X7SS0740002	X7SS0750002	X7SS0760002	X7SS0770002	X7SS0780002	X7SS0790002	X7SS0800002	X7SS0810002	X7SS0820002
location	X7-SB069	X7-SB070	X7-SB071	X7-SB072	X7-SB073	X7-SB074	X7-SB075	X7-SB076	X7-SB077	X7-SB078	X7-SB079	X7-SB080	X7-SB081	X7-SB082
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0690002	X7SS0700002	X7SS0710002	X7SS0720002	X7SS0730002	X7SS0740002	X7SS0750002	X7SS0760002	X7SS0770002	X7SS0780002	X7SS0790002	X7SS0800002	X7SS0810002	X7SS0820002
sample_date	20071005	20071009	20071005	20071004	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_029**	**c_030**	**c_031**	**c_032**	**c_033**	**c_034**	**c_035**	**c_036**	**c_037**	**c_038**	**c_039**	**c_040**	**c_041**	**c_042**
Semivolatile Organics (ug/kg)														
2-METHYLNAPHTHALENE			1.6 U				1.8 U				1.6 U		1.6 U	
ACENAPHTHENE			1.2 U				4.9 J				1.1 U		1.1 U	
ACENAPHTHYLENE			0.64 U				0.71 U				0.63 U		0.64 U	
ANTHRACENE			0.85 U				7.2				0.83 U		0.84 U	
BENZO(A)ANTHRACENE			12				140				0.87 U		0.88 U	
BENZO(A)PYRENE			17				170				0.96 U		0.97 U	
BENZO(B)FLUORANTHENE			20				230				0.87 U		0.88 U	
BENZO(G,H,I)PERYLENE			7.1				48				0.96 U		0.97 U	
BENZO(K)FLUORANTHENE			8.0				92				0.45 U		0.46 U	
CHRYSENE			13				160				0.83 U		0.84 U	
DIBENZO(A,H)ANTHRACENE			1.1 U				18				1.0 U		1.1 U	
FLUORANTHENE			15				180				0.83 U		0.84 U	
FLUORENE			0.65 U				4.6 J				0.64 U		0.64 U	
INDENO(1,2,3-CD)PYRENE			4.8 J				60				1.2 U		1.2 U	
NAPHTHALENE			1.2 U				1.3 U				1.1 U		1.1 U	
PHENANTHRENE			1.1 U				30				1.0 U		1.1 U	
PYRENE			17				200				1.0 U		1.1 U	
Inorganics (mg/kg)														
ALUMINUM							14800							
ANTIMONY							0.93 J							
ARSENIC							8.54							
BARIUM							627							
BERYLLIUM							0.634							
CADMIUM							1.12							
CALCIUM							1930							
CHROMIUM							16.5							
COBALT							10.3							
COPPER							15.0							
IRON							23000							
LEAD, LABCONV	20.0 U	18.40	20.0 U	24.79	36.02	33.19	25.41	20.0 U	20.0 U	23.87	20.0 U	36.02	29.44	27.57
LEAD, LABEQV	20.00 U	18.40	20.00 U	24.79	36.02	33.19	33.10	20.00 U	20.00 U	23.87	20.00 U	36.02	29.44	27.57
LEAD, RAWXRF	20.00 U	22.00	20.00 U	29.00	41.00	38.00	29.67	20.00 U	20.00 U	28.00	20.00 U	41.00	34.00	32.00
MAGNESIUM							1410							
MANGANESE							770							
NICKEL							14.8							
POTASSIUM							853							
SELENIUM							0.575							
SILVER							0.0844							
SODIUM							66.7							
THALLIUM							0.209							
VANADIUM							32.8							
ZINC							63.0							

ANALYTICAL RESULTS
CENTRAL ZONE - UXO 7
NSWC CRANE, CRANE, INDIANA

nsample	X7SS0830002	X7SS0840002	X7SS0850002	X7SS0860002	X7SS0870002	X7SS0880002	X7SS0890002	X7SS0900002	X7SS0910002	X7SS0920002	X7SS0930002	X7SS0940002	X7SS0950002	X7SS0960002
location	X7-SB083	X7-SB084	X7-SB085	X7-SB086	X7-SB087	X7-SB088	X7-SB089	X7-SB090	X7-SB091	X7-SB092	X7-SB093	X7-SB094	X7-SB095	X7-SB096
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0830002	X7SS0840002	X7SS0850002	X7SS0860002	X7SS0870002	X7SS0880002	X7SS0890002	X7SS0900002	X7SS0910002	X7SS0920002	X7SS0930002	X7SS0940002	X7SS0950002	X7SS0960002
sample_date	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071005	20071006	20071006
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_043**	**c_044**	**c_045**	**c_046**	**c_047**	**c_048**	**c_049**	**c_050**	**c_051**	**c_052**	**c_053**	**c_054**	**c_055**	**c_056**
Semivolatile Organics (ug/kg)														
2-METHYLNAPHTHALENE				1.7 U										
ACENAPHTHENE				1.2 U										
ACENAPHTHYLENE				0.68 U										
ANTHRACENE				0.90 U										
BENZO(A)ANTHRACENE				0.95 UJ										
BENZO(A)PYRENE				1.0 UJ										
BENZO(B)FLUORANTHENE				0.95 UJ										
BENZO(G,H,I)PERYLENE				1.0 UJ										
BENZO(K)FLUORANTHENE				0.49 UJ										
CHRYSENE				0.90 UJ										
DIBENZO(A,H)ANTHRACENE				1.1 UJ										
FLUORANTHENE				0.90 U										
FLUORENE				0.69 U										
INDENO(1,2,3-CD)PYRENE				1.3 UJ										
NAPHTHALENE				1.2 U										
PHENANTHRENE				1.1 U										
PYRENE				1.1 UJ										
Inorganics (mg/kg)														
ALUMINUM														
ANTIMONY														
ARSENIC														
BARIUM														
BERYLLIUM														
CADMIUM														
CALCIUM														
CHROMIUM														
COBALT														
COPPER														
IRON														
LEAD, LABCONV	20.0 U	20.0 U	36.02	20.0 U	20.0 U	24.79	24.79	35.08	20.0 U	22.04	20.0 U	20.0 U	44.62	20.0 U
LEAD, LABEQV	20.00 U	20.00 U	36.02	20.00 U	20.00 U	24.79	24.79	35.08	20.00 U	22.04	20.00 U	20.00 U	44.62	20.00 U
LEAD, RAWXRF	20.00 U	20.00 U	41.00	20.00 U	20.00 U	29.00	29.00	40.00	20.00 U	26.00	20.00 U	20.00 U	50.00	20.00 U
MAGNESIUM														
MANGANESE														
NICKEL														
POTASSIUM														
SELENIUM														
SILVER														
SODIUM														
THALLIUM														
VANADIUM														
ZINC														

ANALYTICAL RESULTS
CENTRAL ZONE - UXO 7
NSWC CRANE, CRANE, INDIANA

nsample	X7SS0970002	X7SS0980002	X7SS0990002	X7SS1000002	X7SS1010002	X7SS1020002	X7SS1030002	X7SS1040002	X7SS1050002	X7SS1060002	X7SS1070002	X7SS1080002	X7SS1090002	X7SS1100002
location	X7-SB097	X7-SB098	X7-SB099	X7-SB100	X7-SB101	X7-SB102	X7-SB103	X7-SB104	X7-SB105	X7-SB106	X7-SB107	X7-SB108	X7-SB109	X7-SB110
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS0970002	X7SS0980002	X7SS0990002	X7SS1000002	X7SS1010002	X7SS1020002	X7SS1030002	X7SS1040002	X7SS1050002	X7SS1060002	X7SS1070002	X7SS1080002	X7SS1090002	X7SS1100002
sample_date	20071007	20071007	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071009	20071009	20071009	20071006
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_057**	**c_058**	**c_059**	**c_060**	**c_061**	**c_062**	**c_063**	**c_064**	**c_065**	**c_066**	**c_067**	**c_068**	**c_069**	**c_070**
Semivolatile Organics (ug/kg)														
2-METHYLNAPHTHALENE														
ACENAPHTHENE														
ACENAPHTHYLENE														
ANTHRACENE														
BENZO(A)ANTHRACENE														
BENZO(A)PYRENE														
BENZO(B)FLUORANTHENE														
BENZO(G,H,I)PERYLENE														
BENZO(K)FLUORANTHENE														
CHRYSENE														
DIBENZO(A,H)ANTHRACENE														
FLUORANTHENE														
FLUORENE														
INDENO(1,2,3-CD)PYRENE														
NAPHTHALENE														
PHENANTHRENE														
PYRENE														
Inorganics (mg/kg)														
ALUMINUM														
ANTIMONY														
ARSENIC														
BARIUM														
BERYLLIUM														
CADMIUM														
CALCIUM														
CHROMIUM														
COBALT														
COPPER														
IRON														
LEAD, LABCONV	20.0 U	20.0 U	32.56	20.0 U	32.25	40.31	22.95	24.79	26.64	20.0 U	23.87	21.74	21.74	36.02
LEAD, LABEQV	20.00 U	20.00 U	32.56	20.00 U	32.25	40.31	22.95	24.79	26.64	20.00 U	23.87	21.74	21.74	36.02
LEAD, RAWXRF	20.00 U	20.00 U	37.33	20.00 U	37.00	45.50	27.00	29.00	31.00	20.00 U	28.00	25.67	25.67	41.00
MAGNESIUM														
MANGANESE														
NICKEL														
POTASSIUM														
SELENIUM														
SILVER														
SODIUM														
THALLIUM														
VANADIUM														
ZINC														

ANALYTICAL RESULTS
CENTRAL ZONE - UXO 7
NSWC CRANE, CRANE, INDIANA

nsample	X7SS1110002	X7SS1120002	X7SS1130002	X7SS1140002	X7SS1150002	X7SS1160002	X7SS1170002	X7SS1180002	X7SS1190002	X7SS1200002	X7SS1210002	X7SS1220002	X7SS1230002	X7SS1240002
location	X7-SB111	X7-SB112	X7-SB113	X7-SB114	X7-SB115	X7-SB116	X7-SB117	X7-SB118	X7-SB119	X7-SB120	X7-SB121	X7-SB122	X7-SB123	X7-SB124
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1110002	X7SS1120002	X7SS1130002	X7SS1140002	X7SS1150002	X7SS1160002	X7SS1170002	X7SS1180002	X7SS1190002	X7SS1200002	X7SS1210002	X7SS1220002	X7SS1230002	X7SS1240002
sample_date	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071007	20071006	20071006	20071006	20071006	20071006
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_071**	**c_072**	**c_073**	**c_074**	**c_075**	**c_076**	**c_077**	**c_078**	**c_079**	**c_080**	**c_081**	**c_082**	**c_083**	**c_084**
Semivolatile Organics (ug/kg)														
2-METHYLNAPHTHALENE						3.9 J					40	1.8 U	7.0	
ACENAPHTHENE						30					550 J	1.3 U	95	
ACENAPHTHYLENE						0.64 U					0.75 U	0.73 U	27	
ANTHRACENE						64					970	0.96 U	170	
BENZO(A)ANTHRACENE						640					6400	10	1200	
BENZO(A)PYRENE						890 J					8100 J	14	1600 J	
BENZO(B)FLUORANTHENE						1400 J					12000 J	20	2700 J	
BENZO(G,H,I)PERYLENE						340 J					2900 J	5.7 J	730 J	
BENZO(K)FLUORANTHENE						490 J					4700 J	6.4 J	880 J	
CHRYSENE						730					7400	13	1500	
DIBENZO(A,H)ANTHRACENE						69 J					970 J	1.2 U	150 J	
FLUORANTHENE						780					8700	14	1300	
FLUORENE						16					270	0.74 U	42	
INDENO(1,2,3-CD)PYRENE						330 J					2900 J	4.7 J	670 J	
NAPHTHALENE						1.2 U					1.4 U	1.3 U	1.0 U	
PHENANTHRENE						280					4900	1.2 U	680	
PYRENE						1200					14000	15	2700	
Inorganics (mg/kg)														
ALUMINUM														
ANTIMONY														
ARSENIC														
BARIUM														
BERYLLIUM														
CADMIUM														
CALCIUM														
CHROMIUM														
COBALT														
COPPER														
IRON														
LEAD, LABCONV	31.31	30.37	26.64	20.0 U	26.64	20.0 U	26.34	26.95	32.25	22.95	26.34	33.19	32.72	36.34
LEAD, LABEQV	31.31	30.37	26.64	20.00 U	26.64	20.00 U	26.34	26.95	32.25	22.95	26.34	33.19	32.72	36.34
LEAD, RAWXRF	36.00	35.00	31.00	20.00 U	31.00	20.00 U	30.67	31.33	37.00	27.00	30.67	38.00	37.50	41.33
MAGNESIUM														
MANGANESE														
NICKEL														
POTASSIUM														
SELENIUM														
SILVER														
SODIUM														
THALLIUM														
VANADIUM														
ZINC														

nsample	X7SS1250002	X7SS1260002	X7SS1270002	X7SS1280002	X7SS1290002	X7SS1300002	X7SS1310002	X7SS1320002	X7SS1330002	X7SS1340002	X7SS1350002	X7SS1360002	X7SS1370002	X7SS1380002
location	X7-SB125	X7-SB126	X7-SB127	X7-SB128	X7-SB129	X7-SB130	X7-SB131	X7-SB132	X7-SB133	X7-SB134	X7-SB135	X7-SB136	X7-SB137	X7-SB138
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1250002	X7SS1260002	X7SS1270002	X7SS1280002	X7SS1290002	X7SS1300002	X7SS1310002	X7SS1320002	X7SS1330002	X7SS1340002	X7SS1350002	X7SS1360002	X7SS1370002	X7SS1380002
sample_date	20071006	20071007	20071007	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006	20071006
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
sort	**c_085**	**c_086**	**c_087**	**c_088**	**c_089**	**c_090**	**c_091**	**c_092**	**c_093**	**c_094**	**c_095**	**c_096**	**c_097**	**c_098**
Semivolatile Organics (ug/kg)														
2-METHYLNAPHTHALENE					1.6 U							1.7 U		
ACENAPHTHENE					1.2 U							1.2 U		
ACENAPHTHYLENE					0.65 U							0.68 U		
ANTHRACENE					4.2 J							0.90 U		
BENZO(A)ANTHRACENE					55							0.95 U		
BENZO(A)PYRENE					88							1.0 U		
BENZO(B)FLUORANTHENE					130							0.95 U		
BENZO(G,H,I)PERYLENE					36							1.0 U		
BENZO(K)FLUORANTHENE					48							0.49 U		
CHRYSENE					76							0.90 U		
DIBENZO(A,H)ANTHRACENE					1.1 U							1.1 U		
FLUORANTHENE					76							0.90 U		
FLUORENE					0.66 U							0.69 U		
INDENO(1,2,3-CD)PYRENE					39							1.3 U		
NAPHTHALENE					1.2 U							1.2 U		
PHENANTHRENE					21							1.1 U		
PYRENE					86							3.2 J		
Inorganics (mg/kg)														
ALUMINUM			19400											
ANTIMONY			0.61 J											
ARSENIC			8.84											
BARIUM			145											
BERYLLIUM			0.883											
CADMIUM			1.43											
CALCIUM			3720											
CHROMIUM			23.9											
COBALT			14.4											
COPPER			24.7											
IRON			26000											
LEAD, LABCONV	27.57	39.19	30.37	28.97	40.79	32.25	38.24	32.56	26.64	29.44	38.56	26.34	24.79	26.64
LEAD, LABEQV	27.57	39.19	25.30	28.97	40.79	32.25	38.24	32.56	26.64	29.44	38.56	26.34	24.79	26.64
LEAD, RAWXRF	32.00	44.33	35.00	33.50	46.00	37.00	43.33	37.33	31.00	34.00	43.67	30.67	29.00	31.00
MAGNESIUM			2510											
MANGANESE			677											
NICKEL			17.1											
POTASSIUM			1750											
SELENIUM			0.405											
SILVER			0.129											
SODIUM			62.2 U											
THALLIUM			0.231											
VANADIUM			38.1											
ZINC			64.4											

ANALYTICAL RESULTS
CENTRAL ZONE - UXO 7
NSWC CRANE, CRANE, INDIANA

nsample	X7SS1390002	X7SS1400002	X7SS1410002	X7SS1850002	X7SS1860002	X7SS1870002	X7SS1880002
location	X7-SB139	X7-SB140	X7-SB141	X7-SB185	X7-SB186	X7-SB187	X7-SB188
project_no	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118	00447_20080118
sample_coc	X7SS1390002	X7SS1400002	X7SS1410002	X7SS1850002	X7SS1860002	X7SS1870002	X7SS1880002
sample_date	20071006	20071006	20071006	20071009	20071009	20071009	20071009
matrix	SO	SO	SO	SO	SO	SO	SO
top_depth	0	0	0	0	0	0	0
bottom_depth	2	2	2	2	2	2	2
depth_unit	FT	FT	FT	FT	FT	FT	FT
sort	**c_099**	**c_100**	**c_101**	**c_102**	**c_103**	**c_104**	**c_105**
Semivolatile Organics (ug/kg)							
2-METHYLNAPHTHALENE							
ACENAPHTHENE							
ACENAPHTHYLENE							
ANTHRACENE							
BENZO(A)ANTHRACENE							
BENZO(A)PYRENE							
BENZO(B)FLUORANTHENE							
BENZO(G,H,I)PERYLENE							
BENZO(K)FLUORANTHENE							
CHRYSENE							
DIBENZO(A,H)ANTHRACENE							
FLUORANTHENE							
FLUORENE							
INDENO(1,2,3-CD)PYRENE							
NAPHTHALENE							
PHENANTHRENE							
PYRENE							
Inorganics (mg/kg)							
ALUMINUM							
ANTIMONY							
ARSENIC							
BARIUM							
BERYLLIUM							
CADMIUM							
CALCIUM							
CHROMIUM							
COBALT							
COPPER							
IRON							
LEAD, LABCONV	39.51	35.55	26.64	20.51	27.57	17.50	19.91
LEAD, LABEQV	39.51	35.55	26.64	20.51	27.57	17.50	19.91
LEAD, RAWXRF	44.67	40.50	31.00	24.33	32.00	21.00	23.67
MAGNESIUM							
MANGANESE							
NICKEL							
POTASSIUM							
SELENIUM							
SILVER							
SODIUM							
THALLIUM							
VANADIUM							
ZINC							

SHORT-TAILED SHREW - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SOUTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Max Soil Concentration (mg/kg)	Max SW Concentration (mg/L)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Inverts.	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics											
ANTIMONY	1.11E+01	0.00E+00	1.11E+01	5.66E-02	0.00E+00	1.89E+00	1.94E+00	5.90E-02	2.76E+00	3.29E+01	7.04E-01
CADMIUM	1.79E+00	0.00E+00	1.32E+01	9.13E-03	0.00E+00	2.24E+00	2.25E+00	7.70E-01	6.90E+00	2.92E+00	3.25E-01
CHROMIUM	6.66E+01	0.00E+00	2.04E+01	3.40E-01	0.00E+00	3.46E+00	3.80E+00	2.40E+00	5.82E+01	1.58E+00	6.54E-02
COPPER	4.27E+02	0.00E+00	2.20E+02	2.18E+00	0.00E+00	3.74E+01	3.96E+01	5.60E+00	8.27E+01	7.06E+00	4.78E-01
LEAD	5.37E+02	0.00E+00	1.28E+02	2.74E+00	0.00E+00	2.18E+01	2.46E+01	4.70E+00	1.86E+02	5.22E+00	1.32E-01
NICKEL	5.02E+01	0.00E+00	2.37E+02	2.56E-01	0.00E+00	4.04E+01	4.06E+01	1.70E+00	1.48E+01	2.39E+01	2.75E+00
SELENIUM	8.10E-01	0.00E+00	7.95E-01	4.13E-03	0.00E+00	1.35E-01	1.39E-01	1.43E-01	6.60E-01	9.74E-01	2.11E-01
VANADIUM	4.63E+01	0.00E+00	1.94E+00	2.36E-01	0.00E+00	3.31E-01	5.67E-01	4.16E+00	9.44E+00	1.36E-01	6.00E-02
ZINC	1.48E+02	0.00E+00	4.41E+02	7.55E-01	0.00E+00	7.49E+01	7.56E+01	7.54E+01	2.98E+02	1.00E+00	2.54E-01

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.525E-02	kg
Food Ingestion Rate = (If)	2.592E-03	kg/day
Water Ingestion Rate = (Iw)	4.300E-03	L/day
Soil Ingestion Rate = (Is)	7.776E-05	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (invertebrates) = (Ci * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (invertebrates)

SHORT-TAILED SHREW - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SOUTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Avg Soil Concentration (mg/kg)	Avg SW Concentration (mg/L)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Inverts.	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics											
ANTIMONY	3.82E+00	0.00E+00	3.82E+00	3.36E-03	0.00E+00	3.73E-01	3.77E-01	5.90E-02	2.76E+00	6.39E+00	1.37E-01
CADMIUM	1.09E+00	0.00E+00	8.87E+00	9.59E-04	0.00E+00	8.67E-01	8.68E-01	7.70E-01	6.90E+00	1.13E+00	1.26E-01
CHROMIUM	2.87E+01	0.00E+00	8.79E+00	2.53E-02	0.00E+00	8.59E-01	8.84E-01	2.40E+00	5.82E+01	3.68E-01	1.52E-02
COPPER	8.30E+01	0.00E+00	4.27E+01	7.29E-02	0.00E+00	4.17E+00	4.25E+00	5.60E+00	8.27E+01	7.58E-01	5.14E-02
LEAD, LABEQV	7.26E+01	0.00E+00	2.55E+01	6.38E-02	0.00E+00	2.49E+00	2.56E+00	4.70E+00	1.86E+02	5.44E-01	1.37E-02
NICKEL	2.69E+01	0.00E+00	2.85E+01	2.37E-02	0.00E+00	2.78E+00	2.81E+00	1.70E+00	1.48E+01	1.65E+00	1.90E-01
SELENIUM	6.29E-01	0.00E+00	6.60E-01	5.53E-04	0.00E+00	6.45E-02	6.50E-02	1.43E-01	6.60E-01	4.55E-01	9.85E-02
VANADIUM	3.23E+01	0.00E+00	1.36E+00	2.84E-02	0.00E+00	1.32E-01	1.61E-01	4.16E+00	9.44E+00	3.87E-02	1.70E-02
ZINC	8.93E+01	0.00E+00	3.73E+02	7.85E-02	0.00E+00	3.65E+01	3.65E+01	7.54E+01	2.98E+02	4.85E-01	1.23E-01

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.687E-02	kg
Food Ingestion Rate = (If)	1.648E-03	kg/day
Water Ingestion Rate = (Iw)	3.800E-03	L/day
Soil Ingestion Rate = (Is)	1.483E-05	kg/day
Home Range = (HR)	9.700E-01	acres
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (invertebrates) = (Ci * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (invertebrates)

AMERICAN WOODCOCK - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SOUTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Max Soil Concentration (mg/kg)	Max SW Concentration (mg/L)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Inverts.	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics											
ANTIMONY	1.11E+01	0.00E+00	1.11E+01	3.32E-01	0.00E+00	2.03E+00	2.36E+00	NV	NV	#VALUE!	#VALUE!
CADMIUM	1.79E+00	0.00E+00	1.32E+01	5.36E-02	0.00E+00	2.40E+00	2.46E+00	1.47E+00	6.35E+00	1.67E+00	3.87E-01
CHROMIUM	6.66E+01	0.00E+00	2.04E+01	1.99E+00	0.00E+00	3.72E+00	5.72E+00	2.66E+00	1.56E+01	2.15E+00	3.66E-01
COPPER	4.27E+02	0.00E+00	2.20E+02	1.28E+01	0.00E+00	4.02E+01	5.30E+01	4.05E+00	3.49E+01	1.31E+01	1.52E+00
LEAD	5.37E+02	0.00E+00	1.28E+02	1.61E+01	0.00E+00	2.34E+01	3.95E+01	1.63E+00	4.46E+01	2.43E+01	8.86E-01
NICKEL	5.02E+01	0.00E+00	2.37E+02	1.50E+00	0.00E+00	4.34E+01	4.49E+01	6.71E+00	1.86E+01	6.69E+00	2.42E+00
SELENIUM	8.10E-01	0.00E+00	7.95E-01	2.43E-02	0.00E+00	1.45E-01	1.69E-01	2.90E-01	8.20E-01	5.84E-01	2.07E-01
VANADIUM	4.63E+01	0.00E+00	1.94E+00	1.39E+00	0.00E+00	3.55E-01	1.74E+00	3.44E-01	1.70E+00	5.06E+00	1.02E+00
ZINC	1.48E+02	0.00E+00	4.41E+02	4.43E+00	0.00E+00	8.05E+01	8.49E+01	6.61E+01	1.71E+02	1.28E+00	4.97E-01

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.660E-01	kg
Food Ingestion Rate = (If)	3.032E-02	kg/day
Water Ingestion Rate = (Iw)	1.900E-02	L/day
Soil Ingestion Rate = (Is)	4.972E-03	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (invertebrates) = (Ci * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (invertebrates)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)
NV = No value available
#VALUE! = Value not able to be calculated

AMERICAN WOODCOCK - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SOUTHERN ZONE - UXO 7
NSWC CRANE, INDIANA

Parameter	Avg Soil Concentration (mg/kg)	Avg SW Concentration (mg/L)	Invertebrate Concentration (mg/kg)	Dose (mg/kg/day) from: Surface Soil	Surface Water	Inverts.	Total Dose (mg/kg/day)	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	NOAEL EEQ	LOAEL EEQ
Inorganics											
ANTIMONY	3.82E+00	0.00E+00	3.82E+00	3.26E-02	0.00E+00	5.10E-01	5.42E-01	NV	NV	#VALUE!	#VALUE!
CADMIUM	1.09E+00	0.00E+00	8.87E+00	9.31E-03	0.00E+00	1.18E+00	1.19E+00	1.47E+00	6.35E+00	8.13E-01	1.88E-01
CHROMIUM	2.87E+01	0.00E+00	8.79E+00	2.45E-01	0.00E+00	1.17E+00	1.42E+00	2.66E+00	1.56E+01	5.33E-01	9.07E-02
COPPER	8.30E+01	0.00E+00	4.27E+01	7.08E-01	0.00E+00	5.70E+00	6.40E+00	4.05E+00	3.49E+01	1.58E+00	1.84E-01
LEAD	7.26E+01	0.00E+00	2.55E+01	6.19E-01	0.00E+00	3.40E+00	4.02E+00	1.63E+00	4.46E+01	2.47E+00	9.01E-02
NICKEL	2.69E+01	0.00E+00	2.85E+01	2.30E-01	0.00E+00	3.80E+00	4.03E+00	6.71E+00	1.86E+01	6.01E-01	2.17E-01
SELENIUM	6.29E-01	0.00E+00	6.60E-01	5.36E-03	0.00E+00	8.80E-02	9.34E-02	2.90E-01	8.20E-01	3.22E-01	1.14E-01
VANADIUM	3.23E+01	0.00E+00	1.36E+00	2.75E-01	0.00E+00	1.81E-01	4.56E-01	3.44E-01	1.70E+00	1.33E+00	2.68E-01
ZINC	8.93E+01	0.00E+00	3.73E+02	7.62E-01	0.00E+00	4.98E+01	5.05E+01	6.61E+01	1.71E+02	7.64E-01	2.95E-01

Cells are shaded if the EEQ is greater than 1.0.

Body Weight = (BW)	1.895E-01	kg
Food Ingestion Rate = (If)	2.526E-02	kg/day
Water Ingestion Rate = (Iw)	1.900E-02	L/day
Soil Ingestion Rate = (Is)	1.617E-03	kg/day
Home Range = (HR)	6.133E+01	acres
Contaminated Area = (CA)	Assume equal to home range	

H=HR/CA (Assume = to 1 for maximum exposure)

Dose (surface soil) = (Cs * Is)(H)/BW
Dose (surface water) = (Cw * Iw)(H)/BW
Dose (invertebrates) = (Ci * If)(H)/BW
Total Dose = Dose (surface soil) + Dose (surface water) + Dose (invertebrates)

Definitions:
EEQ - Ecological Effects Quotient
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Ci = Contaminant conc. in soil invertebrates (=soil conc. * Biotransfer Factor)
NV = No value available
#VALUE! = Value not able to be calculated